

Environmental Projects: Volume 13

Underground Storage Tanks: Removal and Replacement



(NASA-CR-189030) ENVIRONMENTAL PROJECTS.
VOLUME 13: UNDERGROUND STORAGE TANKS,
REMOVAL AND REPLACEMENT. GOLDSTONE DEEP
SPACE COMMUNICATIONS COMPLEX (JPL) 175 p

N92-12035

CSCCL 148 G3/14

Unclas
0052255

Deep Space Communications Complex

JPL
Jet Propulsion Laboratory
California Institute of Technology

NASA
National Aeronautics
Space Administration

February 15, 1991

TO: RECIPIENTS OF GOLDSTONE ENVIRONMENTAL PROTECTION REPORTS

The Office of Telecommunications and Data Acquisition (TDA) at JPL is publishing a series of reports that describes several environmental projects at the Goldstone Deep Space Communications Complex (GDSCC). A report will be issued as each project in the Goldstone Environmental Protection Program is completed.


The three-fold objectives of these reports are:

- 1) To provide Goldstone Maintenance and Operations personnel with details of task implementation.
- 2) To serve as a basis for the documentation of environmental activities at Goldstone, as required by regulatory agencies.
- 3) To provide prototype samples of reports that can be referred to by other organizations that may be planning similar environmental protection and compliance projects.

The planned TDA reports include the following:

<u>Volume Number</u>	<u>Compliance Task</u>	<u>Approximate Issue Date</u>
1	Polychlorinated Biphenyl (PCB) Abatement Program (GDSCC)	Issued
2	Underground Storage Tanks - Compliance Program (GDSCC)	Issued
3	Environmental Compliance Audit: Final Report (GDSCC)	Issued
4	Asbestos Survey (GDSCC)	Issued
5	Part One: Study of Subsurface Contamination (GDSCC) Part Two: Guide to Implement Environ- mental Compliance Programs	Issued
6	Environmental Assessment: New 34M Antenna at Venus Site (GDSCC)	Issued
7	Environmental Resource Document (GDSCC)	Issued
8	Modifications of Wastewater Evaporation Ponds (GDSCC)	Issued
9	Construction of Hazardous Materials Storage Facilities (GDSCC)	Issued
10	Environmental Assessment: Addition to Apollo Site (GDSCC)	Issued
11	Environmental Assessment: Addition to Operations Bldg., Mars Site (GDSCC)	Issued
12	Asbestos Abatement (GDSCC)	Issued
13	Underground Storage Tanks; Removal and Replacement (GDSCC)	This Issue
14	Contaminated Soil/Debris Removal (GDSCC)	5/01/91
15	Environmental Assessment: One Megawatt Transmitter, Mars Site (GDSCC)	6/01/91
16	Waste Minimization	7/01/91
17	Non-Friable Asbestos	8/01/91

If additional copies, information or details are desired, contact
Len Kushner, TDA Safety and Environmental Protection Engineer,
telephone (818) 354-1844, FTS 792-1844.


I. J. Justice, Manager
TDA Resources and Safety

Environmental Projects: Volume 13

Underground Storage Tanks: Removal and Replacement

Goldstone Deep Space Communications Complex

The work described in this publication was carried out under the direction of the Jet Propulsion Laboratory, California Institute of Technology, and was supported by the National Aeronautics and Space Administration.

Reference herein to any specific commercial product, process, or service by trade name, or manufacturer does not necessarily constitute an endorsement by the United States Government, the National Aeronautics and Space Administration, or the Jet Propulsion Laboratory, California Institute of Technology.

ABSTRACT

The Goldstone Deep Space Communications Complex (GDSCC), located in the Mojave Desert about 40 miles north of Barstow, California, and about 160 miles northeast of Pasadena, is part of the National Aeronautics and Space Administration's (NASA's) Deep Space Network, one of the world's largest and most sensitive scientific telecommunications and radio navigation networks. The Goldstone Complex is managed, technically directed, and operated for NASA by the Jet Propulsion Laboratory (JPL) of the California Institute of Technology in Pasadena, California.

Activities at the GDSCC are carried out in support of six large parabolic dish antennas. As a large-scale facility located in a remote, isolated desert region, the GDSCC operations require numerous on-site storage facilities for gasoline, diesel oil, hydraulic oil, and waste oil. These fluids are stored in underground storage tanks (USTs).

Because USTs may develop leaks with the resultant seepage of their hazardous contents into the surrounding soil, San Bernardino County (in which the GDSCC is located), the State of California, and the Federal Government have adopted stringent regulations for the nature, operation, and maintenance of USTs.

In 1986, when the Environmental Projects Program began at the GDSCC, the complex had 27 single-walled USTs. In 1987, following GDSCC temporary compliance with county, state, and Federal regulations regarding USTs, 15 of the original 27 USTs remained in use, 11 USTs had been cleaned and degassed (inerted) for temporary closure, and one UST had been cleaned and permanently closed (abandoned in place). This preliminary compliance work with the original 27 GDSCC USTs is described in JPL Publication 87-4, Environmental Projects: Volume 2, Underground Storage Tanks Compliance Program (June 15, 1987).

This present volume describes what happened to the 26 USTs that remained at the GDSCC. Twenty-four of these USTs were constructed of carbon steel without any coating for corrosion protection, and without secondary containment or leak detection. Two remaining USTs were constructed of fiberglass-coated carbon steel but without secondary containment or leak protection.

This present volume partially is an expanded and updated JPL-version of a Preliminary Engineering Report, entitled Removal and Replacement of Underground Storage Tanks at the GDSCC, submitted by Engineering-Science, Inc., Pasadena, California, to JPL in December 1987.

Of the 26 USTs that remained at the GDSCC, 23 were cleaned, removed from the ground, cut up, and hauled away from the GDSCC for environmentally acceptable disposal. Three USTs were permanently closed (abandoned in place).

To replace the functions of the 26 removed and abandoned, single-walled USTs, the GDSCC installed 13 new, double-walled, fiberglass-coated, steel tanks equipped with a monitoring system, placed in the annular space between the inner and outer walls, to detect failures in either wall of the UST.

In addition, the hydraulic oil interceptor system at the Mars Site was greatly expanded to accommodate the maximum potential release of hydraulic oil from the Mars antenna (DSS 14) to prevent the oil's entry into the environment.

As a result, the GDSCC now has 13 new functioning USTs and an expanded hydraulic oil interceptor system that comply with all county, state, and Federal regulations that govern the use of underground storage tanks and oil interceptors.

GLOSSARY

A/C	Asphalt/Concrete
APCD	Air Pollution Control District
AQMD	Air Quality Management District
BLM	U.S. Bureau of Land Management
CAC	California Administrative Code
Cal/OSHA	California Occupational Safety and Health Administration
CERCLA	Comprehensive Environmental Response, Conservation and Liability Act (Federal)
CFR	Code of Federal Regulations
CM	Corrugated Metal
DHS	Department of Health Services (California)
DOSH	Division of Occupational Safety and Health (California)
DSCC	Deep Space Communications Complex
DSN	Deep Space Network
DSS	Deep Space Station
EA	Environmental Assessment
EIC	Engineer in Charge
EPA	U.S. Environmental Protection Agency (see U.S. EPA)
E-S	Engineering-Science, Inc., Pasadena, California
FCS	Fiberglass Coated Steel
FDS	Fuel Dispensing Station
GCF	Ground Communications Facility
GDSCC	Goldstone Deep Space Communications Complex
GSA	General Services Administration (Federal)
H.E.	Heavy Equipment

HEF	High-Efficiency (Antenna)
JPL	Jet Propulsion Laboratory
LEL	Lower Explosive Level
LRWQCB	Lahontan Regional Water Quality Control Board
MBGA	M. B. Gilbert Associates, Long Beach, California
MBS	Mojave Base Site (Goldstone)
MTF	Microwave Test Facility
NASA	National Aeronautics and Space Administration
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NIOSH	National Institute for Occupational Safety and Health
NOAA	National Oceanic and Atmospheric Administration
NOCC	Network Operations Control Center
NTC	National Training Center (U.S. Army)
OSHA	Occupational Safety and Health Administration
PER	Preliminary Engineering Report
R&D	Research and Development
RCRA	Resource Conservation and Recovery Act (Federal)
SBC/DEHS	San Bernardino County/Department of Environmental Health Services
SCANN	Sensor for Control of Arterials and Networks
SETI	Search for Extraterrestrial Intelligence
SOP	Standard Operating Procedure
STS	Space Transportation System (Space Shuttle)
TDA	Office of Telecommunications and Data Acquisition (JPL)
TFC	Technical Facilities Controller
TSCA	Toxic Substances Control Act (Federal)
U.S. EPA	United States Environmental Protection Agency (see EPA)

UST(s)	Underground Storage Tank(s)
VLBI	Very Long Baseline Interferometry
VRS	Vapor Recovery System

~~CONFIDENTIAL~~ 504

CONTENTS

I.	INTRODUCTION	1-1
A.	BACKGROUND OF STATUS OF UNDERGROUND STORAGE TANKS (USTs) AT THE GDSCC	1-1
B.	EXPANSION OF THE HYDRAULIC OIL INTERCEPTOR SYSTEM AT THE MARS SITE	1-4
II.	PRELIMINARY WORK TO BRING UNDERGROUND STORAGE TANKS AT THE GDSCC INTO TEMPORARY COMPLIANCE WITH ENVIRONMENTAL REGULATIONS . .	2-1
A.	COUNTY, STATE, AND FEDERAL REGULATIONS PERTAINING TO UNDERGROUND STORAGE TANKS	2-1
B.	LEAK TESTING OF THE 27 USTs AT THE GDSCC	2-2
III.	THE GOLDSTONE DEEP SPACE COMMUNICATIONS COMPLEX (GDSCC)	3-1
A.	LOCATION OF THE GDSCC	3-1
B.	FUNCTIONS OF THE GDSCC	3-1
C.	FACILITIES AT THE GDSCC	3-3
D.	ANTENNA STATIONS AT THE GDSCC	3-7
1.	Echo Site (DSS 12)	3-7
2.	Venus Site (DSS 13)	3-7
3.	Mars Site (DSS 14 and DSS 15)	3-7
4.	Apollo Site (DSS 16, DSS 17, and DSS 18)	3-8
5.	Mojave Base Site (NOAA Antenna)	3-8
E.	SUPPORT FACILITIES AT THE GDSCC	3-9
1.	Goldstone Dry Lake Airport	3-9
2.	Microwave Test Facility and Fire-Training Area	3-9
3.	Miscellaneous Buildings in the GDSCC Area	3-9
4.	Off-Site Facility at Barstow, California	3-9

F.	NON-STRUCTURAL SUPPORT FACILITIES AT THE GDSCC	3-9
1.	Transportation Network	3-9
2.	Utilities and Services	3-9
G.	SOLID-WASTE MANAGEMENT FACILITIES AT THE GDSCC	3-11
H.	WASTEWATER MANAGEMENT FACILITIES AT THE GDSCC	3-11
I.	UNDERGROUND STORAGE TANKS AT THE GDSCC	3-11
J.	OPERATIONAL RELATIONSHIPS BETWEEN THE GDSCC AND FORT IRWIN . .	3-12
K.	NATURAL ENVIRONMENTAL ASPECTS OF THE GDSCC	3-12
1.	Geology	3-12
2.	Hydrology	3-12
3.	Climatic Conditions	3-12
IV.	WORK CARRIED OUT AT THE GDSCC IN THE REMOVAL/ABANDONMENT OF 26 OLD UNDERGROUND STORAGE TANKS	4-1
A.	INTRODUCTION	4-1
B.	GENERAL PROCEDURES TO EXCAVATE OLD USTs AT THE GDSCC	4-4
C.	GENERAL PROCEDURES TO CLOSE THE EXCAVATION PITS FROM WHICH THE OLD USTs HAD BEEN REMOVED	4-6
D.	SPECIFIC REMOVAL OR ABANDONMENT OF OLD USTs AT THE GDSCC . . .	4-6
1.	Echo Site	4-6
2.	Mars Site	4-15
3.	Mojave Base Site	4-20
4.	Apollo Site	4-28
5.	Goldstone Dry Lake Airport Site	4-28
E.	GENERAL: CLEANING OF THE USTs	4-28
V.	INSTALLATION OF 13 NEW UNDERGROUND STORAGE TANKS AT THE GDSCC . .	5-1
A.	CONSTRUCTION OF THE 13 NEW USTs FOR THE GDSCC	5-1
B.	INSTRUMENTATION FOR THE 13 NEW USTs AT THE GDSCC	5-4

1.	Leak Monitoring Instrumentation	5-4
2.	Instrumentation to Monitor Liquid Levels in USTs	5-4
3.	Remote Station to Monitor the 13 New USTs	5-4
C.	GENERAL PROCEDURES FOR THE INSPECTION AND INSTALLATION OF 13 NEW USTs AT THE GDSCC	5-5
D.	PIPING SPECIFICATIONS FOR THE 13 NEW USTs AT THE GDSCC	5-7
1.	Piping for Unleaded Gasoline USTs	5-7
2.	Piping for Diesel Oil and Waste Oil USTs	5-7
E.	PUMP SPECIFICATIONS FOR NEW USTs AT THE GDSCC	5-7
F.	SPECIFICATIONS FOR OVERFILL PROTECTION AND VAPOR RECOVERY FOR NEW USTs AT THE GDSCC	5-8
G.	SPECIFIC INSTALLATION OF 13 NEW USTs AT THE GDSCC	5-8
1.	Echo Site	5-8
2.	Mars Site	5-19
3.	Mojave Base Site	5-27
H.	GENERAL: CERTIFICATION AND CALIBRATION OF THE 13 NEW USTs AT THE GDSCC	5-27
VI.	EXPANSION OF THE HYDRAULIC OIL INTERCEPTOR SYSTEM AT THE MARS SITE	6-1
A.	RAINWATER RUNOFF COLLECTION AND HYDRAULIC OIL INTERCEPTION AT THE MARS SITE	6-1
B.	NEW HYDRAULIC OIL INTERCEPTOR SYSTEM INSTALLED AT THE MARS SITE	6-1
VII.	CERTIFICATION	7-1

APPENDIXES

A. CORRESPONDENCE CONCERNING THE DESTRUCTION OF 24 OLD TANKS REMOVED FROM THE GDSCC	A-1
B. CLEANING AND EXPLOSION-LEVEL TESTING RECORDS FOR THE OLD USTs AT THE GDSCC	B-1
C. WARRANTIES FOR THE 13 NEW USTs AT THE GDSCC AS PROVIDED BY K&T STEEL CORPORATION, TWIN FALLS, IDAHO	C-1
D. CERTIFICATES OF INSTALLATION FOR THE 13 NEW USTs AT THE GDSCC AS WITNESSED BY JOOR MANUFACTURING, INC., ESCONDIDO, CALIFORNIA	D-1
E. CALIBRATION CHARTS FOR THE 13 NEW USTs AT THE GDSCC AS PROVIDED BY JOOR MANUFACTURING, INC., ESCONDIDO, CALIFORNIA	E-1

Figures

1. Typical Cross Section of a Cylindrical Underground Storage Tank as it Existed in 1988 at the GDSCC	1-2
2. Geographic Relationship of the Goldstone Deep Space Communications Complex to JPL in Pasadena	3-2
3. The Three-Continent NASA Deep Space Network as It Exists in 1991	3-4
4. Schematic Map of the Goldstone DSCC Showing Locations of the Five NASA Deep Space Stations (DSSs) and the Mojave Base Station Operated by NOAA	3-5
5. Major Roads Leading to and at the Goldstone DSCC	3-10
6. Echo Site: Use of Dry Ice to Inert Tanks G25-1G and G25-2G Before Their Closures	4-2
7. Close-up View of the Use of Dry Ice to Inert Tanks G25-1G and G25-2G Before Their Closures	4-3
8. Mars Site: Typical View at the GDSCC of an Excavation to Remove Old UST and Associated Piping	4-5
9. Echo Site: Generalized Plot Plan to Easily Identify Major Building Locations	4-7
10. Echo Site: Detailed Plot Plan as it Was in 1987	4-9
11. Echo Site: Partial Plot Plan Showing Locations of Five Groups of Old USTs as of 1988	4-12
12. Echo Site: Details of Building G27 Area Showing Proximity of UST G27-3D to the Building	4-13

13. Echo Site: Details of Building G25 Area in 1987 Showing UST G25-2G Lying Directly Under Parking Lot Retaining Wall	4-14
14. Echo Site: Excavation to Remove Two Old Diesel USTs Near Bldg. G24, the Generator Building	4-16
15. Echo Site: Location of USTs TF-3D and TF-4D in 1988, East of Main Echo Site Facilities	4-17
16. Echo Site: Details of Diesel Fuel USTs TF-3D and TF-4D in 1988 .	4-18
17. Mars Site: Generalized Partial Plot Plan to Easily Identify Major Building Locations	4-19
18. Mars Site: Partial Excavation of USTs G81-1DA and G81-1DB Adjacent to Generator Building G81	4-21
19. Mars Site: Hydraulic Oil USTs 14-1HO and 14-2HO Near Bldg. G88 Northeast of the Mars Antenna	4-22
20. Mojave Base Site: Generalized Plot Plan Depicting Buildings and USTs as they were in 1987	4-23
21. Mojave Base Site: Detailed Drawing of the Area that Housed the Four M9 USTs Near Bldg. M9	4-25
22. Mojave Base Site: Exhumation of an M9 Diesel UST and the M9-4W0 Waste Oil Tank	4-26
23. Mojave Base Site: UST M27-1G Stored Supply of Unleaded Gasoline for Fuel Dispensing Island	4-27
24. Apollo Site: Generalized Partial Plot Plan Depicting Some Buildings and Two USTs as they were in 1987	4-29
25. Apollo Site: Geographical Relationship Between Bldg. A1 and USTs A1-1G and A1-2G	4-30
26. Apollo Site: Typical Steam Cleaning Equipment Used for Cleaning of Tank Before Tank is Inerted and Sealed	4-31
27. Goldstone Dry Lake Airport: Generalized Plot Plan as it was in 1987	4-32
28. Cross Section of a Typical Double-Walled Underground Storage Tank Now Installed at the GDSCC and Fitted with a Leak-Detection Monitoring System	5-3
29. Typical Holiday Test Procedure to Detect Pinholes in Outer Fiberglass Coat Before UST is Interred	5-6
30. Echo Site: Detailed Plot Plan as of 1990	5-9

31. Echo Site: Generalized Partial Plot Plan Showing Locations of
Seven New USTs, SCANN Unit Building, and Locations of Eight Old
USTs that had been Removed 5-11
32. Echo Site: Installation of a G24, 25,000 Gallon Diesel Tank
Northwest of Bldg. G24 5-13
33. Diagram of New GSA/FDS No. 1 at the GDSCC with its Canopy and
Accessory Equipment 5-14
34. Echo Site: Diagram Showing Location of New GSA/FDS No. 1 5-15
35. Echo Site: Installation of Two New, 10,000 Gallon, Unleaded
Gasoline Tanks at GSA/FDS No. 1 5-16
36. Echo Site: Completed New Fuel Dispensing Station, GSA/FDS No. 1 5-17
37. Echo Site: Diagram Showing Location of New GSA/FDS No. 2 5-18
38. Mars Site: Detailed Plot Plan as of 1990 5-20
39. Mars Site: Generalized Partial Plot Plan Showing Locations of
Five New USTs, SCANN Unit Buildings, and Locations of Five Old
USTs that had been Removed 5-21
40. Mars Site: Typical View of New Double-Walled Piping Leading
From New USTs G81-1D and G81-2D to G81, Generator Building 5-22
41. Mars Site: New Double-Walled Piping Leading from USTs G81-1D
and G81-2D to Bldg. G81 5-23
42. Mars Site: Connection of New Double-Walled Piping to New
USTs G81-1D and G81-2D near Bldg. G81 5-24
43. Mars Site: Backfilling with Pea Gravel of the Excavation Pit
in which USTs G81-1D and G81-2D are Interred 5-25
44. Mars Site: Completed Installation of Interred USTs G81-1D and
G81-2D with Concrete Surfaces 5-26
45. Mojave Base Site: Generalized Partial Plot Plan Showing
Location of New UST M8-1G and Bldg. M8 with SCANN Unit, in
Eastern Part of Site 5-28
46. Mojave Base Site: Location of New GSA/FDS No. 3 with New
UST M8-1G 5-29
47. Mars Site: Rainwater Collection System and Concrete Oil/
Water Separators of the Hydraulic Oil Interceptor System as
they were in 1988 6-2
48. Mars Site: Two Groups, Each of Four Concrete Tanks, Now Form
the New Hydraulic Oil Interceptor System 6-4

49. Mars Site: Cross Section of a Typical, Precast Concrete, 5,000 Gallon Oil/Water Separator Unit of the New Hydraulic Oil Interceptor System	6-5
--	-----

Tables

1. Summary of 27 Old, Original USTs at the GDSCC	1-3
2. Major Facilities at the GDSCC	3-6
3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC	4-33
4. Summary of the Status of 13 New Underground Storage Tanks Now at the GDSCC	5-2

4

1994

1995

SECTION I

INTRODUCTION

A. BACKGROUND OF STATUS OF UNDERGROUND STORAGE TANKS (USTs) AT THE GDSCC

The Goldstone Deep Space Communications Complex (GDSCC), located in the Mojave Desert about 40 miles north of Barstow, California, and about 160 miles northeast of Pasadena, is part of the National Aeronautics and Space Administration's (NASA's) Deep Space Network (DSN), one of the world's larger and most sensitive scientific telecommunications and radio navigation networks. The GDSCC is managed, technically directed, and operated for NASA by the Jet Propulsion Laboratory (JPL) of the California Institute of Technology in Pasadena, California. A detailed description of the GDSCC is presented in Section III of this report.

The GDSCC includes five distinct operational areas named Echo Site, Venus Site, Mars Site, Apollo Site, and Mojave Base Site. Within each of the first four sites is a Deep Space Station (DSS) that consists of at least one parabolic dish antenna and support facilities. Although there are four DSN operational sites at the GDSCC, there now are six operational parabolic dish antennas because two antennas are located at the Mars Site and two are at the Apollo Site. The Mojave Base Site, while it is part of the GDSCC, is not part of the DSN but is operated by the National Oceanic and Atmospheric Administration (NOAA).

As a large-scale facility located in a remote, isolated desert region, the GDSCC operations to support the various DSSs require numerous on-site storage facilities for gasoline, diesel oil, hydraulic oil, and waste oil. The safest and most economical way to store the types and quantities of these fluids is in underground storage tanks (USTs).

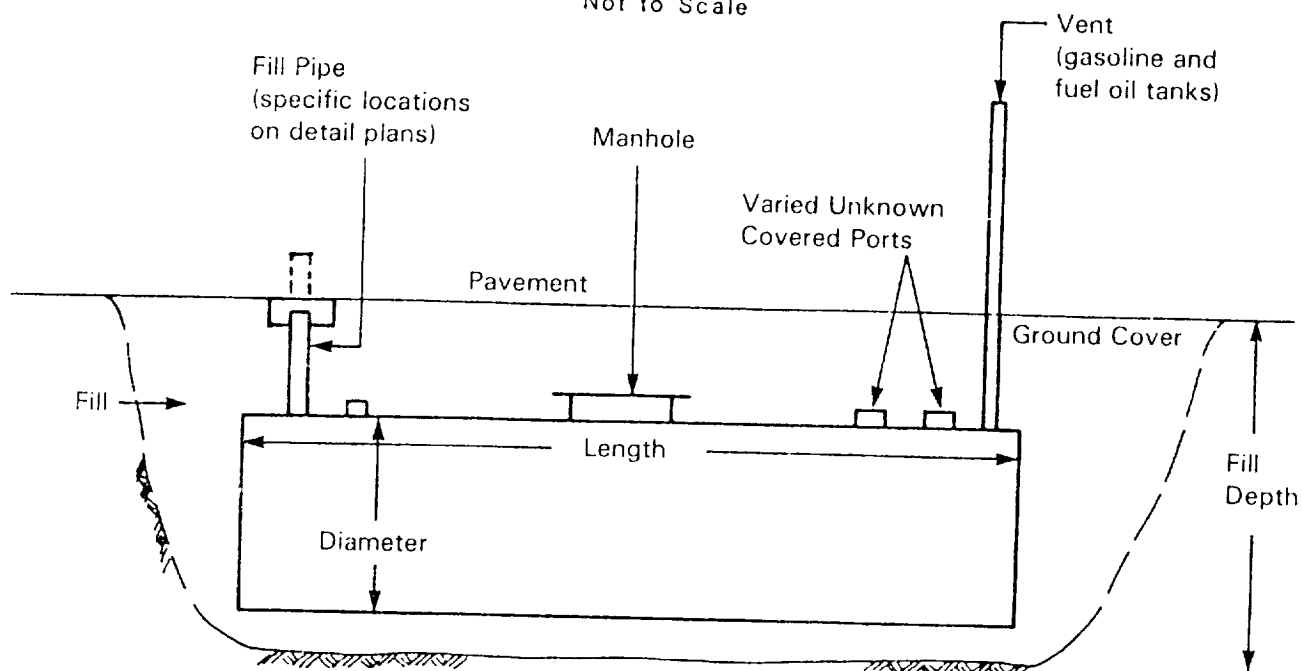
By 1984, the GDSCC had 27 USTs with tank capacities ranging from 500 to 24,000 gal. They were distributed as follows: Echo Site (11 USTs), Mars Site (7 USTs), Mojave Base Site (6 USTs), Apollo Site (2 USTs), and Goldstone Dry Lake Airport (1 UST). Twenty-five of these USTs were constructed of single-wall carbon steel without any outer coating for corrosion protection, and without any secondary containment in the event of a leak and no instrumentation to detect any leak. The two remaining USTs were constructed of single-wall carbon steel with an outer coating of fiberglass for corrosion protection, but without any provision for detection or containment of any leak.

A typical, cross-sectional diagram of the 27 USTs, as they existed at the GDSCC in 1988, is presented in Figure 1. Table 1 is a summary of each of the 27 UST's location, numbered name, age, capacity, product stored, material of construction, and status as of 1988.

In 1989, most of the 27 USTs at the GDSCC (25 of 27) were 15 to 20 years old. This equals or exceeds the average life expectancy of an underground unprotected steel tank. Thus, even without any environmental considerations, many of these old USTs would have to be removed and replaced in the near future.

TYPICAL CROSS SECTION

Not to Scale



Tank No.	Diameter (feet)	Length (feet)	Tank No.	Diameter (feet)	Length (feet)
G25-1G	8	27	G81-2D	8	32
G25-2G	8	27	G81-3D	8	32
G42-1G	6	9.5	14-1WO	unk	unk
G42-2D	6	9.5	14-1HO	8	27
TF-3D	8	32	14-2HO	8	27
TF-4D	8	32	M9-1D	10	41
G27-1D	8	32	M9-2D	10	41
G27-2D	8	32	M9-3D	10	41
G27-3D	8	40	M9-4WO	unk	unk
G24-1D	8	32	A1-1G	8	20
G24-2D	8	32	A1-2G	8	18.5
G81-1DA	10	20	G71-1	8	9.5
G81-1DB	10	20	M27-1G	8	10.5
			M56-1WO	unk	unk

Figure 1. Typical Cross Section of a Cylindrical Underground Storage Tank as it Existed in 1988 at the GDSCC

Table 1. Summary of 27 Old, Original USTs at the GDSCC

Tank Number	Year Installed	Capacity (gal)	Product Stored	Material of Construction	Status as of 1989
<u>Echo Site</u>					
G25-1G	1961	10,000	Unleaded	Steel	Temporary Closure
G25-2G	1969	10,000	Unleaded	Steel	Permanent Closure; Abandoned in Place
G42-1G	1969	2,000	Unleaded	Steel	In Service
G42-2D	1969	2,000	Diesel	Steel	Temporary Closure
TF-3D	1974	12,000	Diesel	Steel	Temporary Closure
TF-4D	1974	12,000	Diesel	Steel	Temporary Closure
G27-1D	1961	12,000	Unleaded	Steel	In Service
G27-2D	1961	12,000	Diesel	Steel	In Service
G27-3D	1960	15,000	Diesel	Steel	In Service
G24-1D	1973	12,000	Diesel	Steel	In Service
G24-2D	1973	12,000	Diesel	Steel	In Service
<u>Mars Site</u>					
G81-1DA	1965	12,000	Diesel	Steel	In Service
G81-1DB	1965	12,000	Diesel	Steel	In Service
G81-2D	1984	12,000	Diesel	FCS*	In Service
G81-3D	1984	12,000	Diesel	FCS*	In Service
14-1W0	1973	920	Waste Oil	Steel	In Service
14-1H0	1971	10,000	Hydraulic Oil	Steel	In Service
14-2H0	1971	10,000	Hydraulic Oil	Steel	In Service
<u>Mojave Base Site</u>					
M9-1D	1964	24,000	Diesel	Steel	In Service
M9-2D	1964	24,000	Diesel	Steel	Temporary Closure
M9-3D	1964	24,000	Diesel	Steel	Temporary Closure
M9-4W0	1964	500	Waste Oil	Steel	Temporary Closure
M56-1W0	1964	7,500	Waste Oil	Steel	Temporary Closure
M27-1G	1960	4,000	Unleaded	Steel	In Service
<u>Apollo Site</u>					
A1-1G	1964	4,000	Unleaded	Steel	Temporary Closure
A1-2G	1964	7,500	Unleaded	Steel	Temporary Closure
<u>Goldstone Dry Lake Airport</u>					
G71-1**	1966	2,000	Aviation Fuel	Steel	Temporary Closure

* Fiberglass Coated Steel.

**A small, 100-gal, aboveground storage tank (G70-1) at the Goldstone Airport also was cleaned and removed from the GDSCC.

The decision to remove and replace these old USTs was accelerated, however, because of county, state, and Federal regulations dealing with USTs that had been enacted in the mid-1980s. Thus, it was decided to remove or abandon in place the old 27 USTs and to replace them with 13 new, double-walled fiberglass-coated, steel tanks equipped with instrumentation to detect any leaks in either the outer or inner shell of the UST.

The 13 new USTs would meet the operating needs of the GDSCC as the most cost-effective and environmentally sound alternative to comply with the county, state, and Federal regulations that pertained to USTs.

This present publication deals with the activities involved in the excavation, cleaning, removal, cutting up, hauling away, and disposing in an environmentally acceptable manner of 23 of the 27 old USTs at the GDSCC. In addition, three of the 27 old USTs at the GDSCC were cleaned, but not removed from the ground. They were filled with a concrete slurry and abandoned in place. One UST, G25-2G, previously had been abandoned in place during preliminary work carried out at the GDSCC in 1986-87.

This preliminary work was done to attain temporary compliance with county, state, and Federal regulations pertaining to the use and maintenance of USTs, and is described in detail in JPL Publication 87-4, Environmental Projects: Volume 2, Underground Storage Tanks Compliance Program (June 15, 1987).

A partial discussion of this preliminary UST environmental work is presented in the next section (Section II) of this publication.

Along with the discussion of the removal/abandonment and disposal of the 27 old USTs, this report also deals with the installation of 13 new USTs to replace the 23 old USTs that had been removed and the 4 old USTs that had been abandoned in place.

B. EXPANSION OF THE HYDRAULIC OIL INTERCEPTOR SYSTEM AT THE MARS SITE

As well as describing the work done at the GDSCC to bring its USTs into compliance with county, state, and Federal environmental regulations, this document also describes the expansion of the capacity of the hydraulic oil interceptor system at the Mars Site. This expansion has resulted in a large enough capacity to be able to accommodate the maximum potential release of hydraulic oil from the Mars antenna (DSS 14).

This added capacity of the interceptor system is an environmentally protective precaution to insure that hydraulic oil will not be released accidentally as a contaminant into the intermittent stream channels located at the Mars Site.

SECTION II

PRELIMINARY WORK TO BRING UNDERGROUND STORAGE TANKS AT THE GDSCC INTO TEMPORARY COMPLIANCE WITH ENVIRONMENTAL REGULATIONS

A. COUNTY, STATE, AND FEDERAL REGULATIONS PERTAINING TO UNDERGROUND STORAGE TANKS (USTs)

By 1984, the GDSCC had 27 USTs dedicated to the storage of gasoline for motor vehicles, diesel oil for electrical generators and heavy equipment, hydraulic oil for antenna operations, and waste oil produced during vehicle and generator maintenance. These USTs were distributed as follows: Echo Site (11 USTs), Mars Site (7 USTs), Mojave Base Site (6 USTs), Apollo Site (2 USTs), and Goldstone Dry Lake Airport (1 UST).

At about the same time (December 1983), laws concerning regulations for the permitting, testing, and managing of USTs were adopted by San Bernardino County, California (the county in which the GDSCC is located). These regulations are listed in Division 8, Title 3, Underground Storage of Hazardous Substances, of the San Bernardino County Code. Immediately thereafter (January 1984), the State of California also adopted similar regulations as described in the State of California Health and Safety Code, Division 20, Chapter 6.7, Underground Storage of Hazardous Substances.

Prior to January 1, 1984 if a city or a county had adopted UST ordinances providing for double-walled containment, monitoring, and permitting that were at least as comprehensive as the state statute, then the city or county could enforce its own ordinances instead of invoking those in the state statute. Thus, for owners and operators of USTs in San Bernardino County, which includes the GDSCC, the environmental regulations of the San Bernardino County ordinance that pertains to USTs take precedence over the state regulations.

The San Bernardino County Ordinance applies to "any one or combination of tanks, including pipes connected thereto, which is used for the storage of hazardous substances and which is substantially or totally beneath the surface of the ground." A "tank" is defined as "any stationary device designed to contain an accumulation of hazardous substances which is constructed primarily of non-earthen materials (e.g., wood, concrete, steel, and plastic) which provides structural support."

The Ordinance applies to "tanks" (as defined above) that store "hazardous substances." These substances are defined to include any liquid or solid listed by the California Director of Industrial Relations, any substance listed by the National Fire Protection Association as a flammable liquid, a Class II or III-A combustible liquid, or which is a hazardous substance pursuant to Health and Safety Code 25316. Hazardous substances listed in the preceding references include any designated hazardous or toxic waste under the Federal Clean Water Act; the Federal Comprehensive Environmental Response, Conservation, and Liability Act (CERCLA); the Federal Resource Conservation and Recovery Act (RCRA); the Federal Clean Air Act; the Federal Toxic Substances Control Act (TSCA); and any waste considered hazardous or extremely hazardous

pursuant to the California hazardous waste control law. Under these definitions and designations, each of the USTs at the GDSCC contained materials that are classified as hazardous substances.

The California State Statutes provide both civil and criminal penalties for owners and operators of USTs found to be in violation of the regulations. Operating a tank without a permit, failing to monitor the tank as required by the permit, failing to maintain records or to report an unauthorized release of a tank's contents, or failing to properly close a tank can subject UST operators to a civil penalty of between \$500 and \$5,000 per day per event. The same penalties apply to owners of USTs for failure to obtain a permit, for failure to repair a UST in accordance with the statute, for abandonment or improper closure of a tank, or for "knowing failure" to "take reasonable and necessary steps to assure compliance...by the operator of an underground tank."

Thus, the passage of county, state, and Federal regulations that pertained to USTs compelled the GDSCC to take action to bring its USTs into compliance with the pertinent environmental regulations.

To do this, the GDSCC first had to determine the condition of its USTs. This led to the decision to test each of its 27 USTs for leaks.

B. LEAK TESTING OF THE 27 USTs AT THE GDSCC

Beginning on December 1, 1986, Kern Environmental Service, a division of Kern Backhoe Service, Inc., Bakersfield, California, began to test the 27 USTs at the GDSCC for leaks.

The test procedure used is known as the Horner Ezy-Check Leak Detection System. This test procedure uses a high- and low-liquid level test to differentiate whether a leak is from the tank itself or from its associated piping.

The high-level test, which involves overfilling a tank by an approximately 3-ft high head of liquid contained in a standing vertical tube, determines whether there are leaks in both the tank and its associated piping. The low-level test, which involves filling a tank only to its capacity, determines whether the tank itself leaks. Of course, if a high-level test indicated no leakage, then a low-level test was not conducted.

Testing of the 27 USTs was completed on February 11, 1987. Interestingly, no leaks involving the tanks themselves were found, but the piping or manways associated with 12 USTs failed the Horner leak test. Faced with these results, the GDSCC decided, with approval from San Bernardino County, to keep 15 USTs temporarily in service, and to temporarily close 11 USTs. The 11 USTs taken out of service, because they no longer were to be used or their piping had failed to pass the Horner leak testing, were emptied, steam-cleaned, degassed, and sealed to place the UST under temporary closure.

One UST, which could not be removed from the ground without extensive damage to adjacent structures and buildings, was decided to be filled with a concrete slurry and be abandoned in place. The specific USTs that were kept temporarily in service, or were temporarily closed, or were abandoned in place, are listed in Table 1. A detailed description of this temporary work at the

GDSCC is presented in JPL Publication 87-4, Environmental Projects: Volume 2, Underground Storage Tanks Compliance Program (June 15, 1987).

This work with the 27 USTs at the GDSCC was only a temporary solution to the UST problem, and received approval from San Bernardino County only if a more permanent solution would be implemented in the near future.

Thus, in 1988-89, the GDSCC resolved its UST environmental problem in a more permanent fashion by removing 23 USTs from the ground, cutting them up, and disposing of them in an environmentally acceptable manner. Three USTs, which would have presented severe difficulties if they were removed from the ground, were abandoned in place. Thus, there are now four abandoned USTs remaining in the ground at the GDSCC, two at the Echo Site and two at the Mars Site.

To replace these removed/abandoned USTs, 13 new USTs were installed to meet the operating needs of the GDSCC as the most cost-effective and environmentally sound alternative to comply with the county, state, and Federal regulations that pertained to USTs.

This present publication describes the work undertaken by the GDSCC (see Section IV) to remove and replace USTs to bring its USTs into an updated environmental compliance with San Bernardino County regulations.

INTERVIEW

END

SECTION III

THE GOLDSTONE DEEP SPACE COMMUNICATIONS COMPLEX (GDSCC)

A. LOCATION OF THE GDSCC

The Goldstone Deep Space Communications Complex (GDSCC) is located in southern California, in a natural, bowl-shaped depression in the Mojave Desert, in San Bernardino County about 40 miles north of Barstow, California, and about 160 miles northeast of Pasadena, California, where the Jet Propulsion Laboratory (JPL) is located.

As indicated in Section I, the GDSCC is part of the National Aeronautics and Space Administration's (NASA's) Deep Space Network (DSN), one of the world's largest and most sensitive scientific telecommunications and radio navigation networks. The Goldstone Complex is managed, technically directed, and operated for NASA by the Jet Propulsion Laboratory of the California Institute of Technology in Pasadena, California.

The 52-mi² Goldstone Complex lies within the western part of the Fort Irwin Military Reservation (Figure 2). A Use Permit for the land was granted to NASA by the U.S. Army. The Complex is bordered by the Fort Irwin Military Reservation on the north, east and southeast; the China Lake U.S. Naval Weapons Center on the northwest; and the state and Federal lands managed by the U.S. Bureau of Land Management (BLM) on the south.

B. FUNCTIONS OF THE GDSCC

After the Space Act of 1958 had accelerated U.S. plans and programs for space exploration, JPL initiated construction work at Goldstone to build the first tracking station of what is now known as the Deep Space Network (DSN). Thus, for more than three decades, the primary purpose of the DSN has been and continues today to support the tracking of both manned and unmanned spacecraft missions and to provide instrumentation for radio and radar astronomy in the exploration of the solar system and the universe.

Over the years, the DSN has become a world leader in the development of low-noise receivers; tracking, telemetry, and command systems; digital signal processing; and deep space radio navigation.

The basic responsibilities of the DSN are to receive telemetry signals from spacecraft, to transmit commands that control the various spacecraft operations, and to generate the radio navigation data used to locate and guide the spacecraft to its destination.

Because of its advanced technical ability to perform the above services, the DSN also is able to carry out the following functions: flight radio-science, radio and radar astronomy, very long baseline interferometry (VLBI), precise measurement of minute earth movements (geodynamics), and participation in the NASA Search for Extraterrestrial Intelligence (SETI).

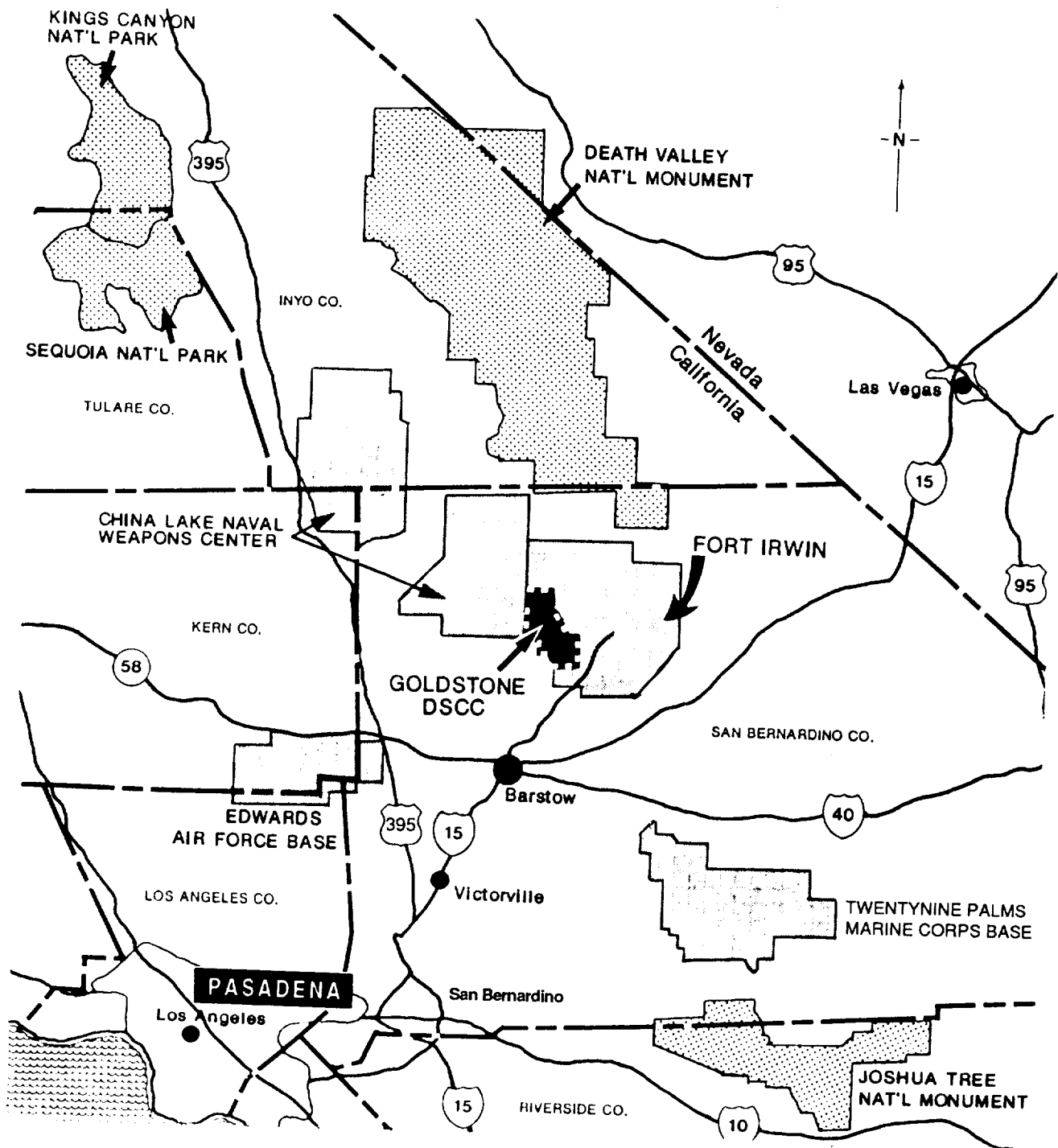


Figure 2. Geographic Relationship of the Goldstone Deep Space Communications Complex to JPL in Pasadena

Goldstone also is a research and development (R&D) center to extend the communication range and to increase the data acquisition capabilities of the DSN. It serves as a proving ground for new operational techniques. Prototypes of all new equipment are thoroughly tested at Goldstone before they are duplicated for installation at overseas stations (see Section III, C below).

C. FACILITIES AT THE GDSCC

The GDSCC is a self-sufficient, working community with its own roads, airstrip, cafeteria, electrical power, and telephone systems, and it is equipped to conduct all necessary maintenance, repairs, and domestic support services. Facilities at the GDSCC include about 100 buildings and structures that were constructed during a 30-year period from the 1950s through the 1980s. The construction of additional buildings and structures continues today as the GDSCC increases its activities and operations.

Goldstone is one of three Deep Space Communications Complexes (DSCCs) operated by NASA. The three DSCCs are located on three continents: at Goldstone in southern California's Mojave Desert; in Spain, about 60 kilometers (37 miles) west of Madrid at Robledo de Chavela; and in Australia, near the Tidbinbilla Nature Reserve, about 40 kilometers (25 miles) southwest of Canberra. Because these three DSCCs are approximately 120 degrees apart in longitude, a spacecraft is nearly always in view of one of the DSCCs as the Earth rotates on its axis (Figure 3).

Activities at the GDSCC support six parabolic dish antennas at five sites called Deep Space Stations (DSSs): Four sites are operational, while one is devoted to R&D activities. There also are four, similar, operational DSSs in Spain and in Australia. Thus, the NASA DSN consists of a worldwide network of 12 operational DSSs. There are three antennas at the Venus Site (for research and development), while another parabolic dish antenna at Goldstone is operated by the National Oceanic and Atmospheric Administration (NOAA).

A Network Operations Control Center (NOCC), located at JPL in Pasadena, controls and monitors the DSN. A Ground Communications Facility (GCF) of the DSN operates to link together the NOCC at JPL with the three DSCCs at Goldstone, Spain, and Australia.

Total NASA/JPL facilities at the GDSCC (Figure 4) include the six DSN parabolic dish antennas, an airport, a microwave test facility, miscellaneous support buildings, and a remote support facility in Barstow, California, located about 40 miles south of the GDSCC. The GDSCC support staff consists of about 260 personnel on-site and at the Barstow facility. Table 2 summarizes the major facilities, buildings (number and square footage), and antennas (construction date and size). Three sites within the GDSCC have antennas (referred to as stations) devoted to NASA DSN operations: Echo Station, Mars Station, Uranus Station, and two antennas at the Apollo Station. Two other sites have antennas devoted to research and development: Venus, operated by the GDSCC, and Mojave, operated by the National Oceanic and Atmospheric Administration.

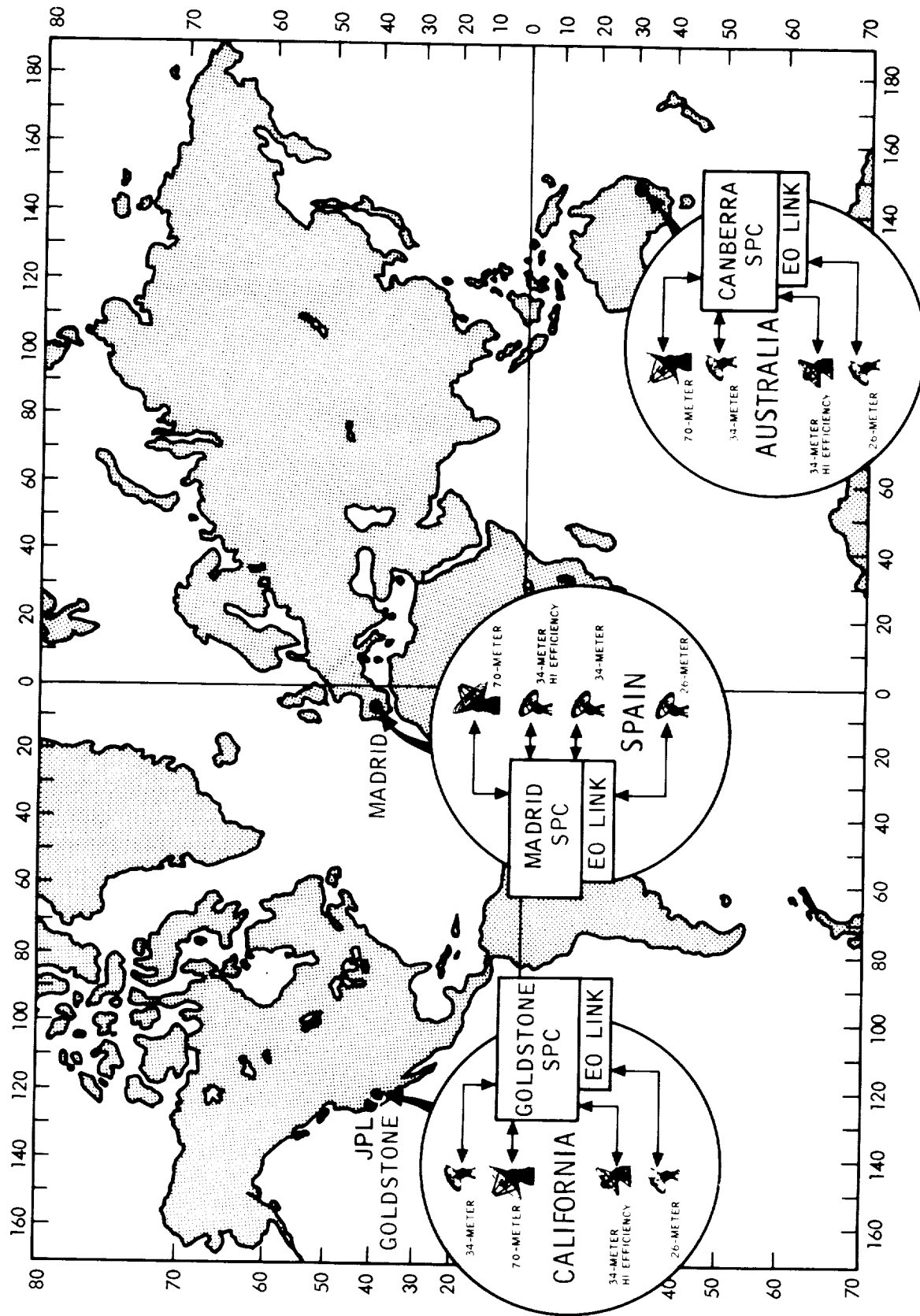


Figure 3. The Three-Continent NASA Deep Space Network as It Exists in 1991

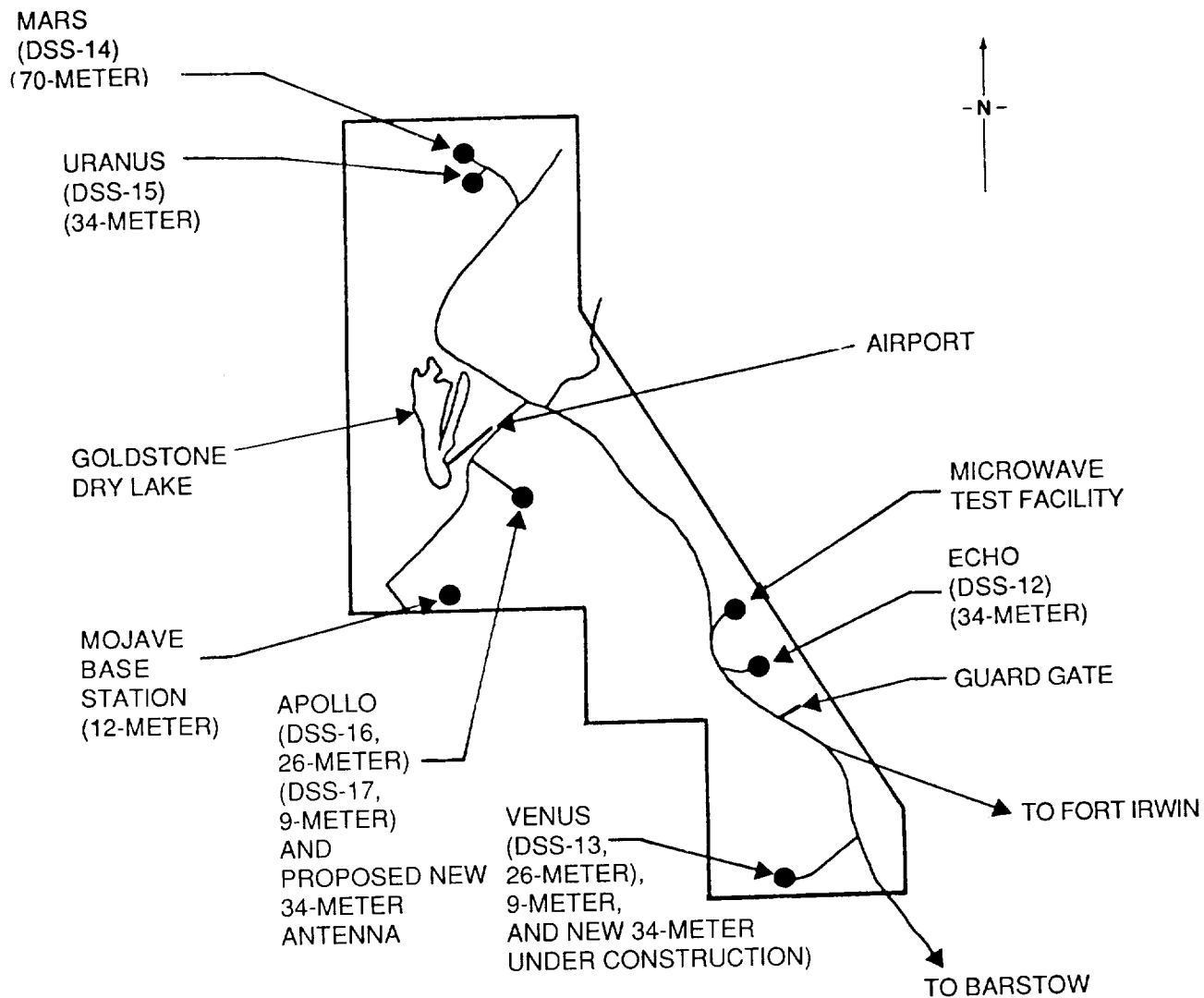


Figure 4. Schematic Map of the Goldstone DSCC Showing Locations of the Five NASA Deep Space Stations (DSSs) and the Mojave Base Station Operated by NOAA

Table 2. Major Facilities at the GDSCC

Site	Station Number	Buildings		Antennas	
		Number	(ft ²)	Date of Construction	Size (Meters)
Echo Site	DSS 12	25	79,208	1961 ^a	34 ^b
Venus Site	DSS 13	15	12,589 ^c	1962 ^d	26
	(present antenna)				9
	DSS 13 (now under construction)				34
Mars Site	DSS 14	14	41,754	1966	70 ^e
	DSS 15			1984	34
Apollo Site	DSS 16	21	43,978	1965 ^f	26
	DSS 17				9
	DSS 18 (proposed)				34
Mojave Site		5	11,850	1964	12 ^g
Airport ^h		3	4,848	1963/1970	--
Microwave Test Facility	MTF	1	2,880	1963	--
Miscellaneous	--	3	1,430	--	--
Barstow Facility ⁱ		1	28,343	--	--

^aThe original antenna, built in 1959, was moved to the Venus Site in 1962. A 26-meter antenna, built in 1961, was extended to 34 meters in 1978.

^bThis antenna is to be dismantled and removed after the DSS 18 antenna at the Apollo Site becomes operational in 1993.

^cThis square footage does not include the two newly constructed facilities for Hazardous Materials Storage and for Acid Wash.

^dThis antenna was constructed at the Echo Site in 1959 and moved to the Venus Site in 1962.

^eOriginally constructed as a 64-meter antenna in 1966, this antenna was enlarged to 70 meters in 1988.

^fThis antenna originally was constructed for the NASA Goddard Space Tracking and Data Network. JPL/GDSCC/DSN operation of the antenna began in October 1984.

^gThis antenna is operated by the National Oceanic and Atmospheric Administration.

^hThe airport is located at the Goldstone Dry Lake.

ⁱThis site, a leased facility, is located in Barstow, California, about 40 miles southwest of the GDSCC.

Source: Directory of Goldstone DSCC Buildings and Supporting Facilities (Gold) Book, Document 880-165, JPL internal document, Jet Propulsion Laboratory and National Aeronautics and Space Administration, Revised Edition, October 1989.

A 26-meter (85-ft) antenna, located at the Pioneer Site, was deactivated in 1981. In 1985, the Pioneer antenna (DSS-11) was designated a National Historic Landmark by the U.S. Department of Interior, and the Pioneer Site was returned to the U.S. Army. Each of the Goldstone sites is briefly described below.

D. ANTENNA STATIONS AT THE GDSCC

1. Echo Site (DSS 12)

The Echo Site, as the administration center and operations headquarters of the GDSCC, is the most extensively developed site on the complex. It has one 34-meter (111.5-ft) antenna and 24 support buildings, with a combined area of 79,208 ft². Support buildings include administration and engineering offices, cafeteria, dormitory, transportation and maintenance facilities, storage areas, and warehouses. The Echo Station originally was built in 1959 as a 26-meter (85-ft) antenna. The antenna was first used in 1960 to support the Echo Project, an experiment to transmit voice communications coast-to-coast by bouncing radio signals off the reflective Mylar surface of a passive balloon-type satellite. In 1962, this original 26-meter antenna was moved to the Venus Site. In anticipation of this move, a newer 26-meter antenna had been built at the Echo Site in 1961. In 1978, this antenna was enlarged to 34 meters (111.5 ft). The present antenna is approximately 35 meters (113 ft) high and weighs about 270,000 kilograms (300 tons). In 1993, it is to be replaced by the new DSS 18 34-meter antenna that is proposed to be constructed at the Apollo Site.

2. Venus Site (DSS 13)

The Venus Site consists of two antennas: a 26-meter (85-ft) antenna and a 9-meter (29.5-ft) antenna. The smaller antenna is no longer used. There are 15 buildings having a combined area of 12,589 ft². The support buildings provide space for operations control, laboratories, offices, security, workshops, warehouses, and mechanical equipment. The 26-meter antenna, which was originally located at the Echo Site, was moved to the Venus Site in 1962. The antenna was used for a radar astronomy study of the planet Venus. Currently, its primary functions are research and development and performance- and reliability-testing of high-power radio-frequency transmitters and new systems and equipment prior to their introduction into the Deep Space Network.

A new 34-meter (111.5-ft) antenna is now under construction to replace the 26-meter antenna. The new DSS 13 antenna is planned to begin research and development activities in 1991. An Environmental Assessment concerning this new antenna is the subject of JPL Publication 87-4, Volume 6, Environmental Assessment: New 34-Meter Antenna at Venus Site (June 15, 1988).

3. Mars Site (DSS 14 and DSS 15)

The Mars Site consists of two antennas and 14 buildings, with a combined area of 41,754 ft². The support buildings provide facilities for operations control, offices, training, mechanical equipment, storage, and security. In May 1989, M. B. Gilbert Associates (MBGA), Long Beach, California, submitted an Environmental Assessment to JPL concerning the construction work needed for a proposed building extension to the Operations Building (Bldg. G-86) at the Mars Site.

JPL Publication 87-4, Volume 11, Environmental Assessment: Addition to Operations Building, Mars Site (February 15, 1990), is an expanded JPL-version of the EA document submitted to JPL by MBGA in May 1989.

The Mars Station Antenna (DSS-14), at 70 meters (230 ft) in diameter, is one of the larger antennas of its kind in the world (see front cover). The antenna, which was constructed as a 64-meter antenna in 1966 and enlarged to 70 meters in 1988, is 7.25 times more powerful and sensitive than a 26-meter antenna, extending the range of deep space communications by 2.7 times. It can maintain communications with spacecraft to the edge of the solar system. Standing more than 235 ft high, this antenna is one of the more striking features to be seen in the GDSCC geographic area. The 70-meter antenna was used in August 1989 for the Voyager 2 spacecraft's encounter with the planet Neptune. The latter is located at a distance of 4.5 billion kilometers (2.8 billion miles) from Earth.

The Uranus Station Antenna (DSS-15) is a 34-meter, high-efficiency (HEF), precision-shaped antenna, located approximately 1,600 ft southeast of the Mars Station Antenna. Built in 1984, this latest antenna at the GDSCC first was used in January 1986 to support the encounter of the Voyager 2 spacecraft with the planet Uranus. The latter is located at a distance of more than 3 billion kilometers (1.8 billion miles) from Earth. The new, proposed 34-meter, precision-shaped antennas, now under construction at the Venus Site (see above) and proposed for the Apollo Site (see below), are similar in size and structure to this Uranus Station antenna.

4. Apollo Site (DSS 16, DSS 17, and DSS 18)

The Apollo Site has a 26-meter (85-ft) antenna (DSS 16), a 9-meter (29.5-ft) antenna (DSS 17), and 21 buildings, with a combined total area of 43,978 ft². The buildings provide space for operations, equipment, storage, and warehousing. The 26-meter antenna originally was constructed in 1965 by NASA's Goddard Space Tracking and Data Network to support the manned Apollo missions to the moon. Operation of this antenna under JPL management began in October 1984. Both the 26-meter and the 9-meter antennas now are used to support the missions of the Space Shuttle (STS) and satellites in both low and high Earth orbits. In May 1989, M. B. Gilbert Associates, Long Beach, California, submitted an Environmental Assessment to JPL concerning the construction work needed for a proposed new 34-meter (111.5-ft) antenna (DSS-18) at the Apollo Site. The details of this Environmental Assessment are described in JPL Publication 87-4, Volume 10, Environmental Assessment: New 34-Meter Antenna at Apollo Site (January 15, 1990).

5. Mojave Base Site (NOAA Antenna)

The Mojave Base Site has one antenna and five buildings, with a combined area of 11,850 ft². At one time, these buildings provided support facilities for operations, equipment, and maintenance. Except for the National Oceanic and Atmospheric Administration (NOAA) operations buildings, however, these buildings now are not in use.

The Mojave Base Site Antenna is a 12-meter (40-ft) antenna operated by NOAA. The antenna is involved in several programs, including monitoring of shifts in the Earth's tectonic plates, monitoring weather changes, and retrieving information from very low-orbiting Earth satellites.

E. SUPPORT FACILITIES AT THE GDSCC

1. Goldstone Dry Lake Airport

The airport consists of an approximately 6,000- by 100-ft paved runway. There are two buildings at the airport site, neither of which is presently in use. An open hangar is used to provide shelter for a single aircraft. For its personnel, NASA operates three scheduled shuttle flights per week to the GDSCC that originate from the Burbank-Glendale-Pasadena Airport. In addition, the Goldstone airport is used infrequently by administrative Army flights. Both NASA and the U.S. Army use propeller-driven aircraft.

2. Microwave Test Facility and Fire-Training Area

The Microwave Test Facility (MTF) and Fire-Training Area consist of a single building of 2,880 ft² along with areas identified for fire fighting. The MTF is used for research and development testing of antenna microwave equipment. Fire training includes procedures for the quenching of fires.

3. Miscellaneous Buildings in the GDSCC Area

Three buildings and structures at the GDSCC that fall into this category include the main gatehouse, pump house, and radio spectrum monitor. The total area of these three buildings/structures is 1,430 ft².

4. Off-Site Facility at Barstow, California

In addition to the above-mentioned on-site facilities, the GDSCC leases an office and warehouse support facility in the nearby city of Barstow. The facility is a single-story, 28,343-ft² structure located at 850 Main Street.

F. NON-STRUCTURAL SUPPORT FACILITIES AT THE GDSCC

1. Transportation Network

The major roadways in the area are shown in Figure 5. The only surface public transportation route to the GDSCC is by the Fort Irwin Road that leads to Fort Irwin. The NASA Road cutoff from Fort Irwin Road leads into the GDSCC. NASA Road merges with Goldstone Road, which is the only north-south paved access road within the complex. Both NASA and Goldstone Roads are paved two-lane roads and are maintained by the Fort Irwin Post Engineer. Two-lane paved access roads also lead to each of the sites and major facilities.

2. Utilities and Services

The Southern California Edison Company provides electricity for the Goldstone Complex. The GDSCC provides its own backup diesel-engine generators for operations during emergencies and to ensure continuity of electrical service for prescheduled periods of time. Gasoline, diesel oil, and hydraulic oil are stored in double-walled underground storage tanks fitted with sensors between the walls to detect leaks. Water is supplied by Fort Irwin from groundwater basin wells. Sanitary sewage is discharged through septic tank

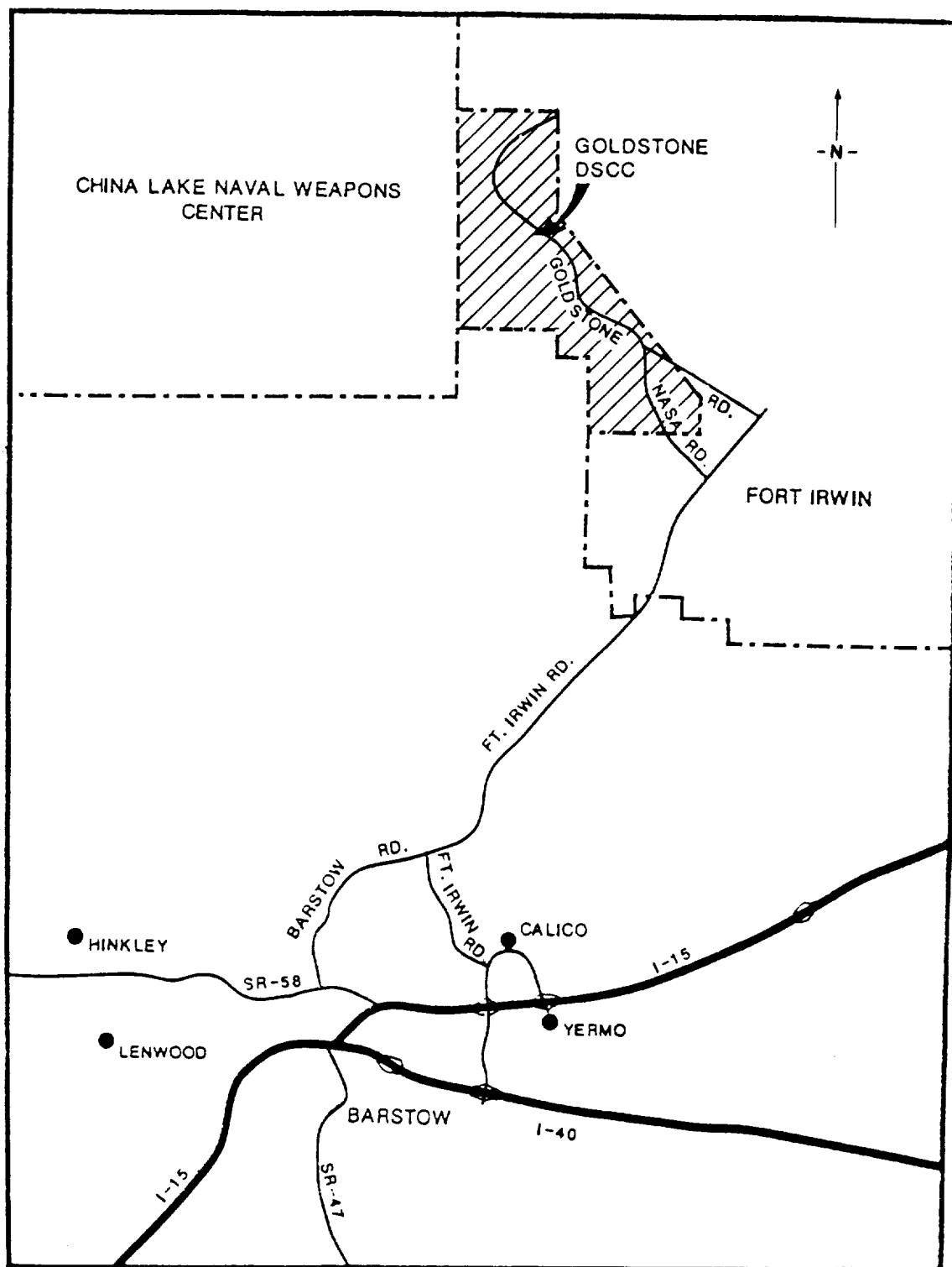


Figure 5. Major Roads Leading to and at the Goldstone DSCC

systems to leaching fields. The Echo and Mars Sites discharge wastewater to evaporation ponds (see JPL Publication 87-4, Environmental Projects: Volume 8-Modifications of Wastewater Evaporation Ponds (October 15, 1989)).

G. SOLID-WASTE MANAGEMENT FACILITIES AT THE GDSCC

At the Echo Site, the GDSCC operates its own 10-acre, Class III solid-waste landfill. This facility accepts only nonhazardous, solid wastes.

Most of a small quantity of hazardous waste, generated at the GDSCC each year, is sent to off-site commercial facilities for reclamation and eventual reuse. The remainder is transported to off-site commercial treatment or disposal facilities within 90 days of generation. The GDSCC now has four, new, properly managed storage facilities for hazardous materials and wastes, one is located at the Echo Site and another at the Venus Site, but operates no facilities requiring a hazardous waste permit. Details concerning the construction of these two new storage facilities for hazardous materials and wastes at the Echo and Venus Sites are described in JPL Publication 87-4, Environmental Projects: Volume 9, Construction of Hazardous Materials Storage Facilities, November 15, 1989. Two more storage facilities for hazardous materials and wastes, one at the Mars Site and the other at the Apollo Site, were completed in 1990. In accordance with its environmental management program, the GDSCC conducts all of its waste-management operations in strict compliance with environmental regulations, in a manner consistent with protection of human health and the environment.

H. WASTEWATER MANAGEMENT FACILITIES AT THE GDSCC

Four functioning sewage evaporation ponds -- one pair at the Echo Site and another pair at the Mars Site -- are designed to receive effluent from upstream septic tank systems. Extensive work was completed in the spring of 1989 to repair and reshape the previously eroded embankments of the wastewater evaporation ponds. Details of this construction work are recorded in JPL Publication 87-4, Environmental Projects: Volume 8, Modifications of Wastewater Evaporation Ponds, October 15, 1989.

I. UNDERGROUND STORAGE TANKS AT THE GDSCC

As a large-scale facility located in a remote, isolated desert region, the GDSCC operations to support the various DSS antennas require numerous on-site storage facilities for gasoline, diesel oil, hydraulic oil, and waste oil. The most environmentally safe and economical way to store large quantities of these liquids is in double-walled, steel shells with outer fiberglass coating for corrosion protection, and a monitoring system in the annular space between the inner and outer shells to detect any leaks in either shell.

The installation of 13 new underground storage tanks with the above-described, environmentally safe properties (7 at the Echo Site, 5 at the Mars Site, and one at the Mojave Base Site) is discussed in detail in this present volume.

J. OPERATIONAL RELATIONSHIPS BETWEEN THE GDSCC AND FORT IRWIN

Because the GDSCC is located within the Fort Irwin property, the two installations potentially can affect each other's roles and missions. Fort Irwin is a U.S. Army installation serving as the U.S. Army National Training Center (NTC). The remote desert environment allows military task forces to practice large-scale training maneuvers that could affect natural, historic, and cultural resources at the GDSCC. This especially is true when the maneuvers involve the movement of heavy equipment (tanks, large trucks) within the GDSCC. Most maneuvers occur at the eastern border of the GDSCC, and every effort is made by both the GDSCC and Fort Irwin personnel to avoid the use of sensitive areas for such maneuvers.

K. NATURAL ENVIRONMENTAL ASPECTS OF THE GDSCC

1. Geology

The GDSCC is located in the North Central section of the Mojave Desert Province. Typically, the Mojave Desert Province consists of broad, flat plains separated by low mountains (1,000 to 2,000 ft of topographic relief). The GDSCC is situated within one of these low mountain areas.

The GDSCC is located in a naturally occurring bowl-shaped depression bounded on three sides by geological faults. The Garlock Fault lies to the north, while the Blackwater and Calico Faults lie, respectively, to the west and south. The GDSCC is bounded on the east by the Tiefort Mountains. Each antenna site at the GDSCC is located on natural alluvial material, ranging in thickness from 15 feet at the Venus Site to more than 70 feet at the Echo Site. The alluvium is derived from the surrounding hills.

2. Hydrology

Groundwater in the Goldstone area is generally confined and is found at depths ranging from 170 ft near the Minitrack Site to approximately 1,000 ft below the Echo Site. Chemical analyses of the groundwater have yielded total dissolved solids (TDS) values in excess of 1,000 ppm, indicating that the groundwater is brackish. The Goldstone Complex currently obtains potable water from a group of wells located at Fort Irwin, approximately 10 miles to the southeast.

3. Climatic Conditions

The GDSCC lies within the U.S. Naval Weather Service's Southwest Desert, Climatic Area A. Mean annual temperatures for the area range from 50°F to 80°F. Temperatures can climb as high as 114°F during the summer months, and drop as low as 11°F during the winter months. Mean annual precipitation for the area is approximately 2.5 in.; most precipitation falls between November and February.

SECTION IV

WORK CARRIED OUT AT THE GDSCC IN THE REMOVAL/ABANDONMENT OF 26 OLD UNDERGROUND STORAGE TANKS

A. INTRODUCTION

In December 1988, work began to bring the USTs at the GDSCC into final compliance with county, state, and Federal environmental regulations. The Contractor who performed the work is Jenkin Construction Co., Long Beach, California, while the work was overseen by Engineering-Science, Inc., Pasadena, California.

The progress of the work, which was completed in mid-May 1989, is summarized in a chronology of work involved in removal and replacement of USTs at the GDSCC (see Table 3 at the end of this Section).

When the work began in late 1988, there were 27 USTs at the GDSCC. Their original use and geographical distribution were as follows:

(1) Echo Site: Eleven USTs, of which 6 were in service, 4 were temporarily closed, and one was permanently closed and abandoned in place. Of the 11 USTs, 7 were diesel fuel tanks, and 4 were unleaded gasoline tanks. One of these unleaded gasoline tanks, G25-2G, had been emptied, steam cleaned, degassed (inerted), filled with a concrete slurry and abandoned in place as a result of previous work that had been performed during 1986-87 (see Section II).

(2) Mars Site: Seven USTs, of which all 7 were in service. Of the 7 USTs, 4 were diesel fuel tanks, 2 were hydraulic oil tanks, and one was a waste oil tank.

(3) Mojave Base Site: Six USTs, of which 2 were in service and 4 were temporarily closed. Of the 6 USTs, 3 were diesel fuel tanks, 2 were waste oil tanks, and one was an unleaded gasoline tank.

(4) Apollo Site: Two USTs, both of which were unleaded gasoline tanks and both were temporarily closed.

(5) Goldstone Dry Lake Airport Site: One UST that was an aviation fuel tank and was temporarily closed. A small, 100-gal, aboveground, aviation fuel tank (G70-1) also was at this site.

Temporary closure of a tank means that the UST was emptied of its contents and steam cleaned to remove any residual sludge. Fifteen (15) pounds of solid carbon dioxide (Dry Ice) then were placed into the cleaned tank for each 1,000 gallons of the tank's volume to purge the tank's interior of any flammable vapors to levels that precluded any fire or explosion hazard. The use of Dry Ice to inert USTs G25-1G and G25-2G is depicted in Figures 6 and 7. Finally, the UST was sealed with a concrete cap to allow the tank to be disposed of in the future in an environmentally acceptable way.

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



Figure 6. Echo Site: Use of Dry Ice to Inert Tanks G25-1G and G25-2G Before Their Closures

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



Figure 7. Close-up View of Use of Dry Ice to Inert Tanks G25-1G and G25-2G Before Their Closures

B. GENERAL PROCEDURES TO EXCAVATE OLD USTs AT THE GDSCC

Procedures to excavate USTs at the GDSCC and the subsequent closure of their excavation pits were carried out in compliance with San Bernardino County/Department of Environmental Health Services (SBC/DEHS) environmental requirements and regulations.

Prior to the start of any tank closures, permits to close each of the GDSCC USTs were obtained from the SBC/DEHS. After issuance of the SBC/DEHS permits, a GDSCC excavation permit was obtained by the JPL project manager because scheduling of tank removal operations was needed to take into account various regulatory site inspection requirements, critical tracking periods, and other GDSCC activities.

Before the start of a tank-excavation procedure, any remaining liquid and/or sludge was removed from the tank. Only after this was done was the tank exposed and the piping disconnected. Care was taken during the disconnection of the piping to prevent any residual liquids in the pipes from being released into the excavation. A combustible-gas meter was used during the excavation procedures to indicate whether there were any potentially hazardous concentrations of combustible vapors. A typical view of an excavation to remove an old UST and its associated piping is shown in Figure 8.

Each tank was rendered inert prior to its removal from the excavation. This was achieved by steam cleaning the tank to remove any residual liquids. The cleaned tank then was degassed to purge any remaining combustible vapors. Degassing, also known as inerting, was performed by placing solid carbon dioxide (Dry Ice) into the tank shell in a ratio of 15 pounds of dry ice per 1,000 gallons of tank capacity. The combustible-gas meter was used to monitor the effectiveness of the degassing procedure.

Before the present work began, 11 USTs at the GDSCC had been temporarily closed. These USTs had previously been emptied and rendered inert (degassed). After confirming that these 11 temporarily closed tanks, listed in Table 1, were still inert (using a combustible-gas meter), they were removed from the excavation without any additional steam cleaning or degassing.

If there was visual or olfactory (odor) evidence of soil contamination when the tanks were removed, the SBC/DEHS tank-removal inspector required that soil samples be collected from the excavation bottom. These samples were forwarded to a State-certified analytical laboratory and analyzed for the various compounds that had been stored in the tank. If soils were contaminated, they were disposed of, after analysis, at a permitted hazardous waste disposal facility.

Vent, product, and recirculation lines entering the excavation either were removed or capped at both ends of the piping run. Underground electrical, water, and air lines and all aboveground piping were removed unless a portion of them were to be reused in one of the new tank installations. Pumps, pump islands, old concrete, and asphalt were removed from the excavation area. These materials, along with any removed piping, were transported to the GDSCC on-site solid waste disposal facility at the Echo Site.

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



Figure 8. Mars Site: Typical View at the GDSCC of an Excavation to Remove
Old UST and Associated Piping

The fates of the 23 old UST shells that were removed, and that of the single small aboveground tank at the Goldstone Dry Lake Airport, varied as follows: eight of the 24 old tank shells were cut up as scrap at the GDSCC and the scrap was delivered to Avalon Salvage, Inc., Hinkley, California, while 16 of the 24 old tank shells were hauled intact to Avalon Salvage, Inc., where they were destroyed. The correspondence concerning the destruction of the 24 old tank shells is presented in Appendix A.

C. GENERAL PROCEDURES TO CLOSE THE EXCAVATION PITS FROM WHICH THE OLD USTs HAD BEEN REMOVED

After the USTs at the GDSCC were exhumed from their respective excavations, the excavation pits were closed by backfilling, compaction, and, where appropriate, resurfacing with asphalt and/or concrete. Backfill material was available from native soils near each excavation. The backfill material was compacted to 95 percent of maximum density at optimum moisture. Compaction testing was required at several sites to assure future integrity of surface covers and nearby buildings. All concrete used in resurfacing the filled and compacted excavation pits at the GDSCC contains Lytle Creek Aggregate.

The only exception to this general closure procedure was the excavation of the G81-2D and G82-3D USTs at the Mars Site. After the two USTs were removed from this excavation, the excavation was not filled but was enlarged to accommodate the two new 25,000 gallon USTs, G82-1D and G81-2D, for the Mars Generator Building (G-81). Closure of this particular excavation pit was carried out in accordance with the SBC/DEHS requirements for the installation of new USTs.

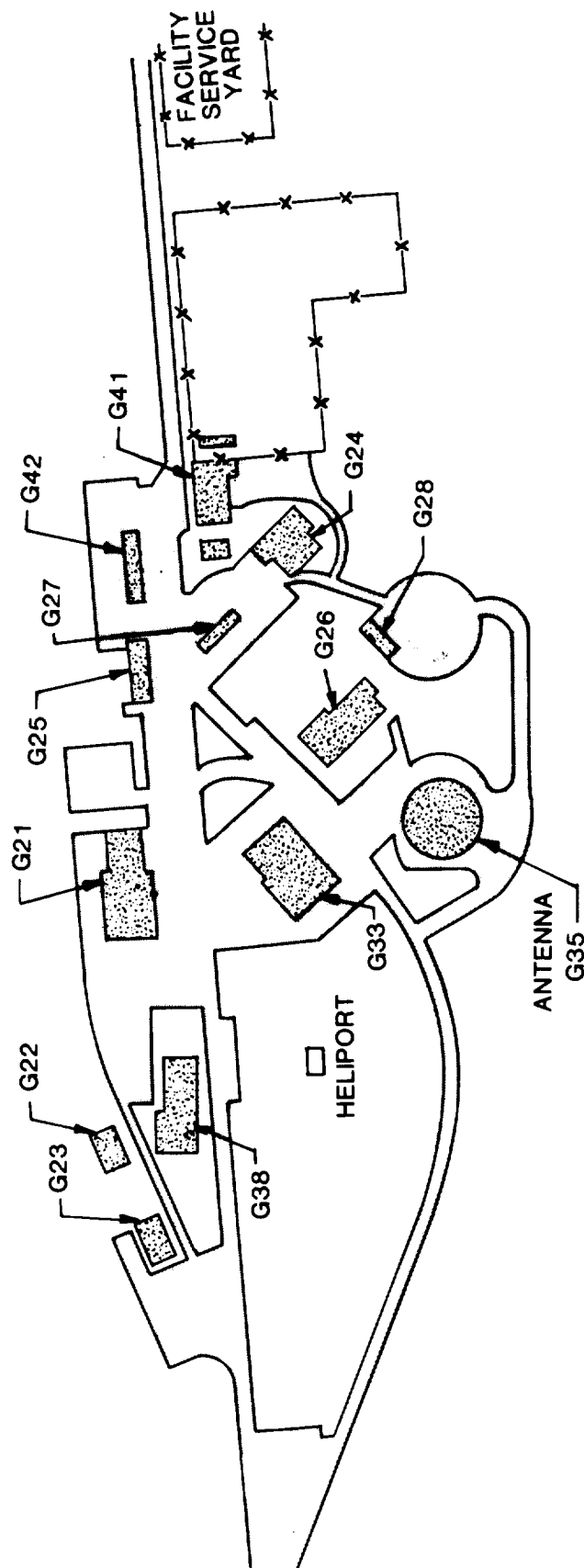
D. SPECIFIC REMOVAL OR ABANDONMENT OF OLD USTs AT THE GDSCC

Of the original 27 old USTs at the GDSCC, one already had been abandoned in place in 1987. The 1988-89 work described in this present publication, therefore, only had to deal with 26 USTs, 15 of which were in service, and 11 of which had been closed temporarily. Of these 26 USTs, 23 were removed from the ground, cut up, hauled away, and disposed of in an environmentally acceptable manner. Two USTs at the Mars Site, and one at the Echo Site, however, because of possible structure and building damage that could occur during their excavation, were not removed but were abandoned in place. Thus, of the original 27 USTs at the GDSCC, four USTs now remain abandoned in the GDSCC ground.

The removal of the 23 USTs from the ground is described, by site, as follows:

(1) Echo Site:

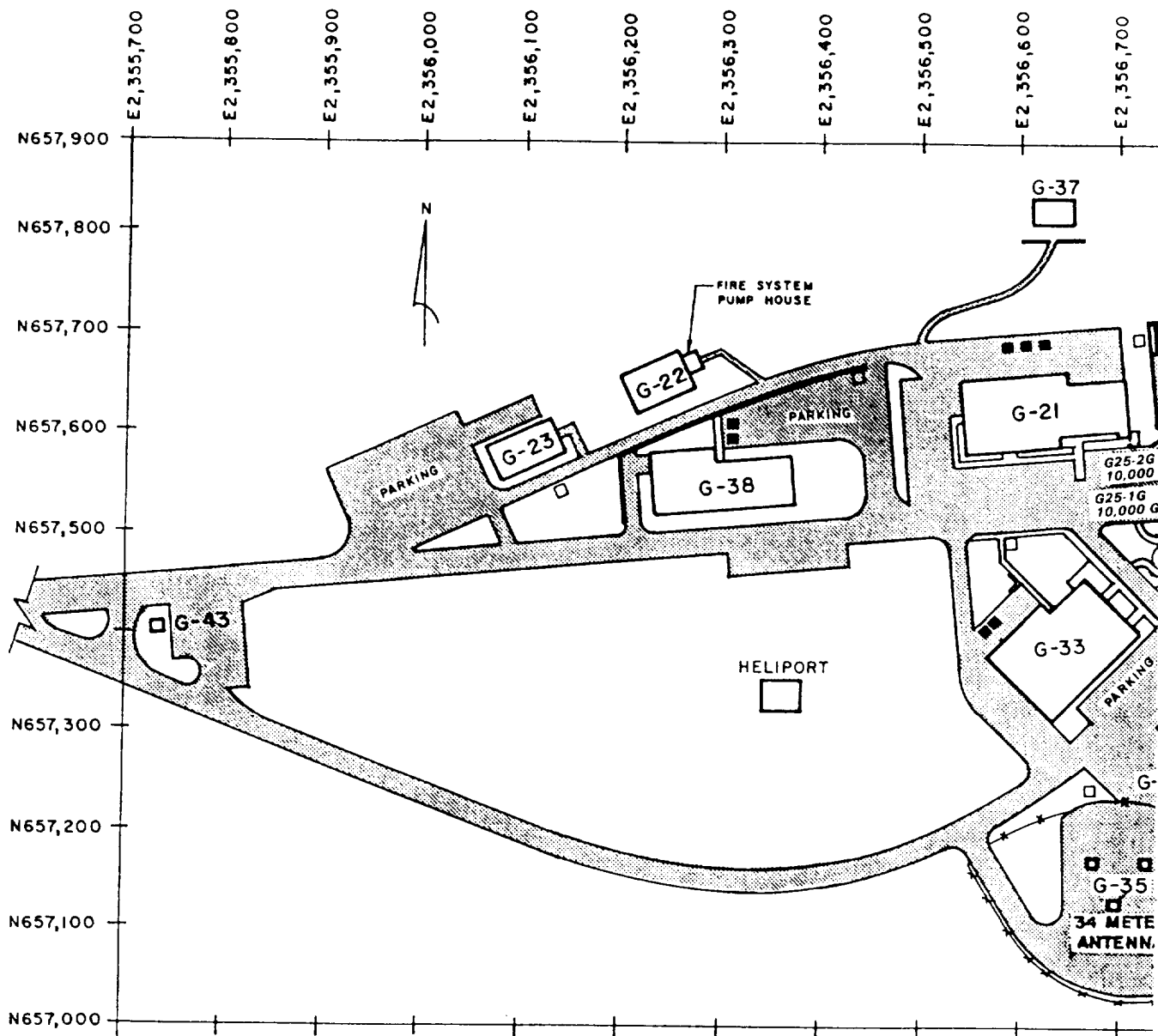
A generalized plot plan to permit the easy location of the major buildings at the Echo Site is depicted in Figure 9. A more detailed plot plan of the Echo Site as it was in 1987 is shown in Figure 10.



SCALE 1" = 260 FEET

Figure 9. Echo Site: Generalized Plot Plan to Easily Identify Major Building Locations

INTENTIONALLY BLANK



LEGEND:

- TRAILER OR VAN LOCATION
- ▨ ASPHALT PAVEMENT
- ✕ ACCESS CONTROL FENCE
- FIRE HYDRANT AND HOSE HOUSE
- △ TV TOWER
- LIGHT TOWER (SURVEILLANCE TV)
- DUMPSTER LOCATION
- FUEL TANK D-DIESEL
- G-GASOLINE
- SEPTIC TANK

PRECEDING PAGE BLANK NOT FILMED

~~SECRET~~

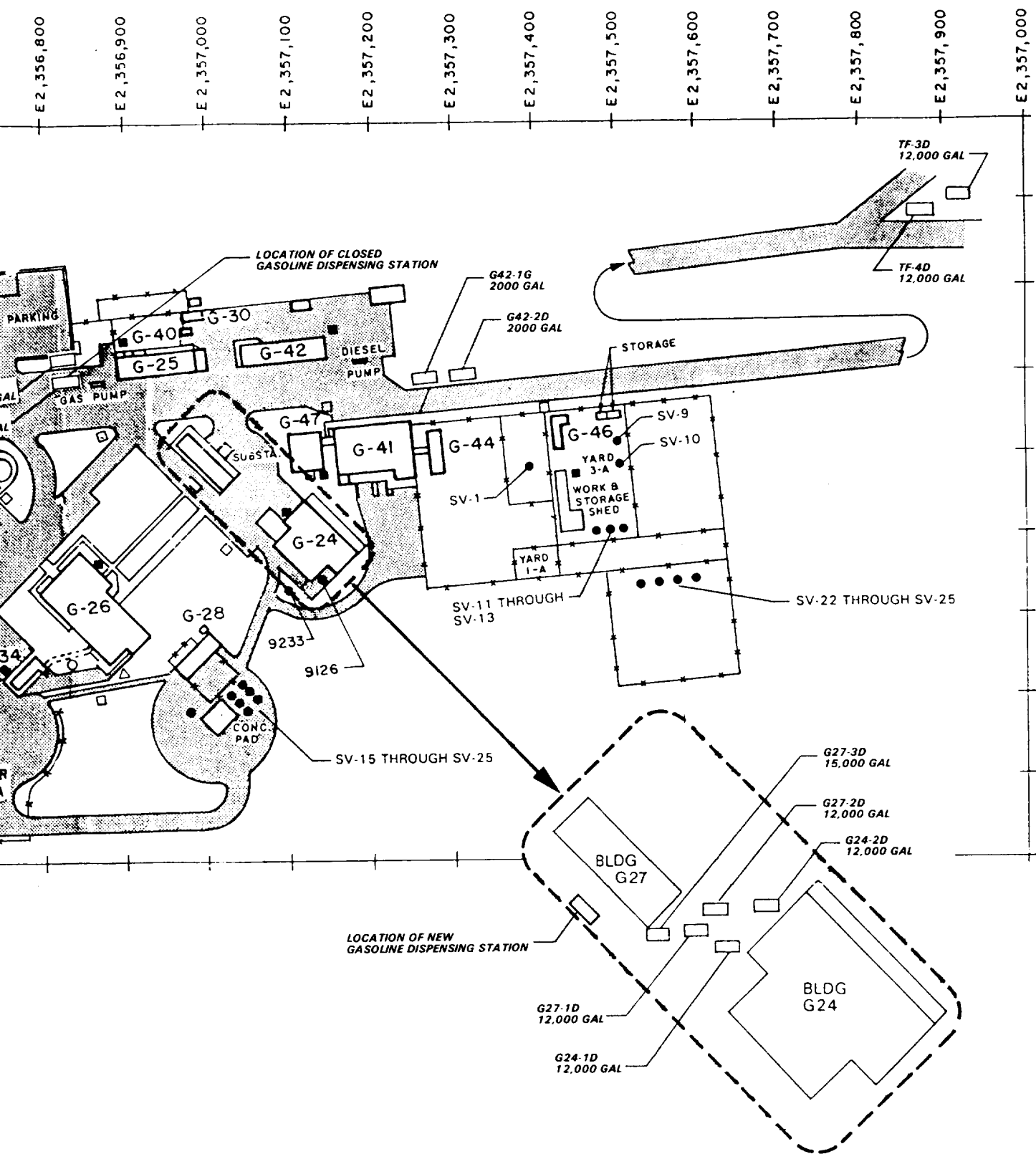


Figure 10. Echo Site: Detailed Plot Plan as it was in 1987

a. UST Group G27

This group of three diesel-fuel USTs (G27-1D, G27-2D, and G27-3D) was among the oldest USTs at the GDSCC: the 12,000 gal G27-1D and the 12,000 gal G27-2D were installed in 1961, while the 15,000 gal G27-3D was installed in 1960. The three tanks were located southeast of Building G-27 as depicted in Figure 11, a partial plot of the Echo Site that shows the locations of five groups old USTs. Building G-27 is an Office/Storage Building.

In December 1986, each of the three G-27 USTs had passed a Horner leak test and each was kept in service. USTs G27-1D and G27-2D were retained as diesel fuel tanks, while UST G2-3D, the 15,000 gal tank, was converted to a temporary unleaded gasoline tank designated G27-1G. This diesel oil-to-unleaded gasoline conversion made up for the losses of two previous gasoline-dispensing tanks, UST G25-1G (temporary closure) and UST G25-2G (abandoned in place).

Thus, UST G27-3D also may be referred to in this report as UST G27-1G; both designations, however, refer to the same UST.

USTs G27-1D and G27-2D were steam cleaned, inerted, exhumed, and the tank shells were hauled away from the GDSCC. The area from which these two USTs had been removed was backfilled, compacted, and resurfaced with concrete.

Because UST G27-3D, however, was adjacent to Bldg. G-27 (see Figure 12), it could not be removed without resultant damage to the building. Thus, it was decided to steam clean, inert, fill the tank with a concrete slurry and abandon the UST in place. This was the second UST at the Echo Site to be abandoned in place; UST G25-2G previously had been abandoned in 1987.

b. UST Group G25

This was a group of two unleaded gasoline USTs. UST G25-1G was a 10,000 gal tank installed in 1961, while UST G25-2G was a 10,000 gal tank installed in 1969. The two tanks were located almost due west of Building G-25 (see Figure 11). Building G-25 is a Transportation/Maintenance Building.

Because UST G25-2G lay directly under a retaining wall of an adjacent parking lot, it could not be removed without extensive damage to the surface structures (see Figure 13). In December 1986, UST G25-2G was steam cleaned, inerted, filled with a concrete slurry, and abandoned in place. This was the first UST at the GDSCC to be abandoned in place.

The second tank of UST Group 25, UST G25-1G, which had been temporarily closed, was steam cleaned, inerted, exhumed, and the tank shell was hauled away from the GDSCC. The area from which the UST had been removed was backfilled, compacted, and resurfaced with concrete.

c. UST Group G42

This was a group of two, 2,000 gal tanks installed in 1969: UST G42-1G was an unleaded gasoline tank, while G42-2D stored diesel fuel. The two tanks were located southeast of Bldg. G-42, the garage building (see Figure 11). In 1986, UST G42-1G passed the Horner leak test and was kept in service, while the piping associated with G42-2D failed the Horner leak test and the UST was temporarily closed.

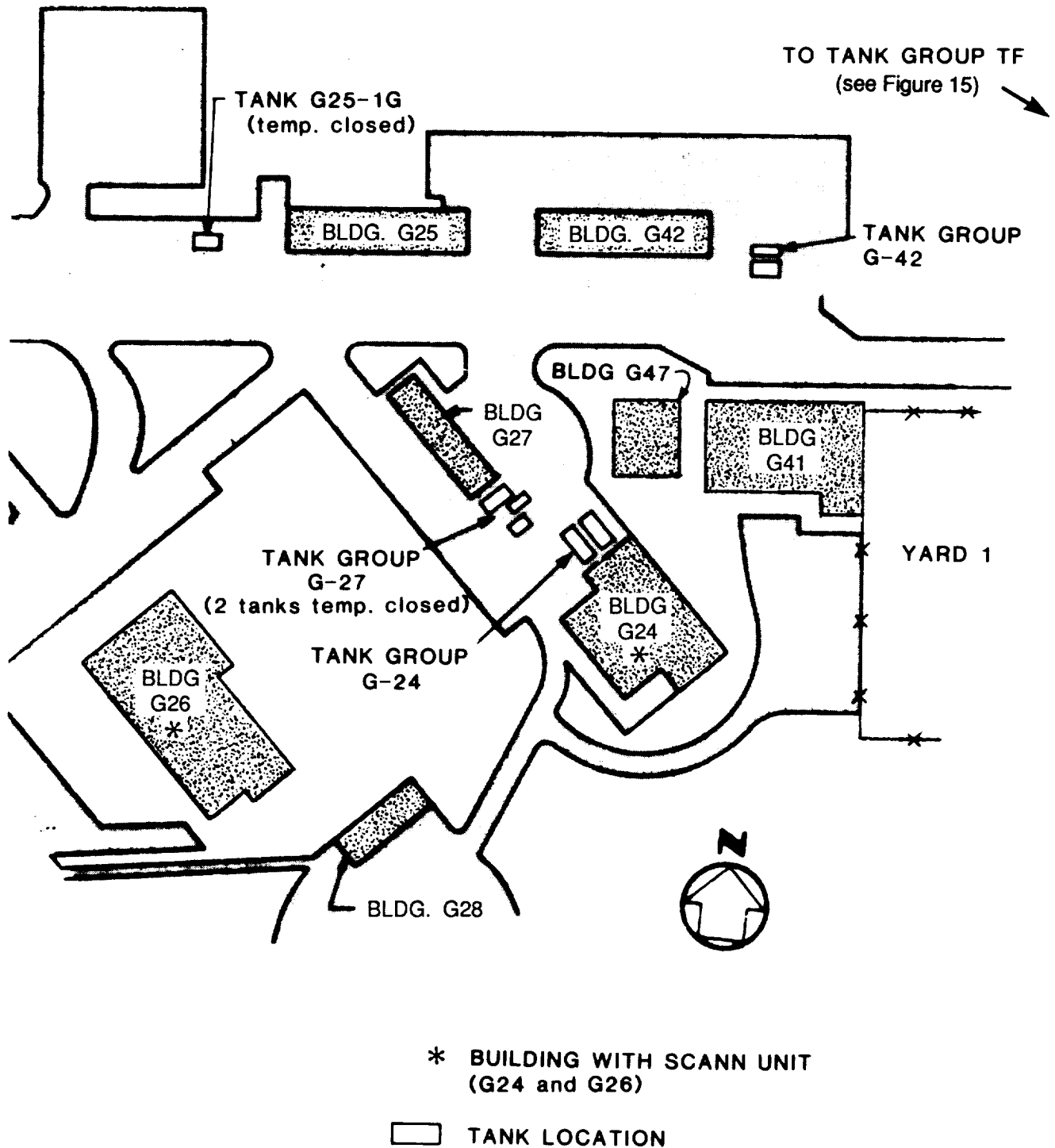


Figure 11. Echo Site: Partial Plot Plan Showing Locations of Five Groups of Old USTs as of 1988

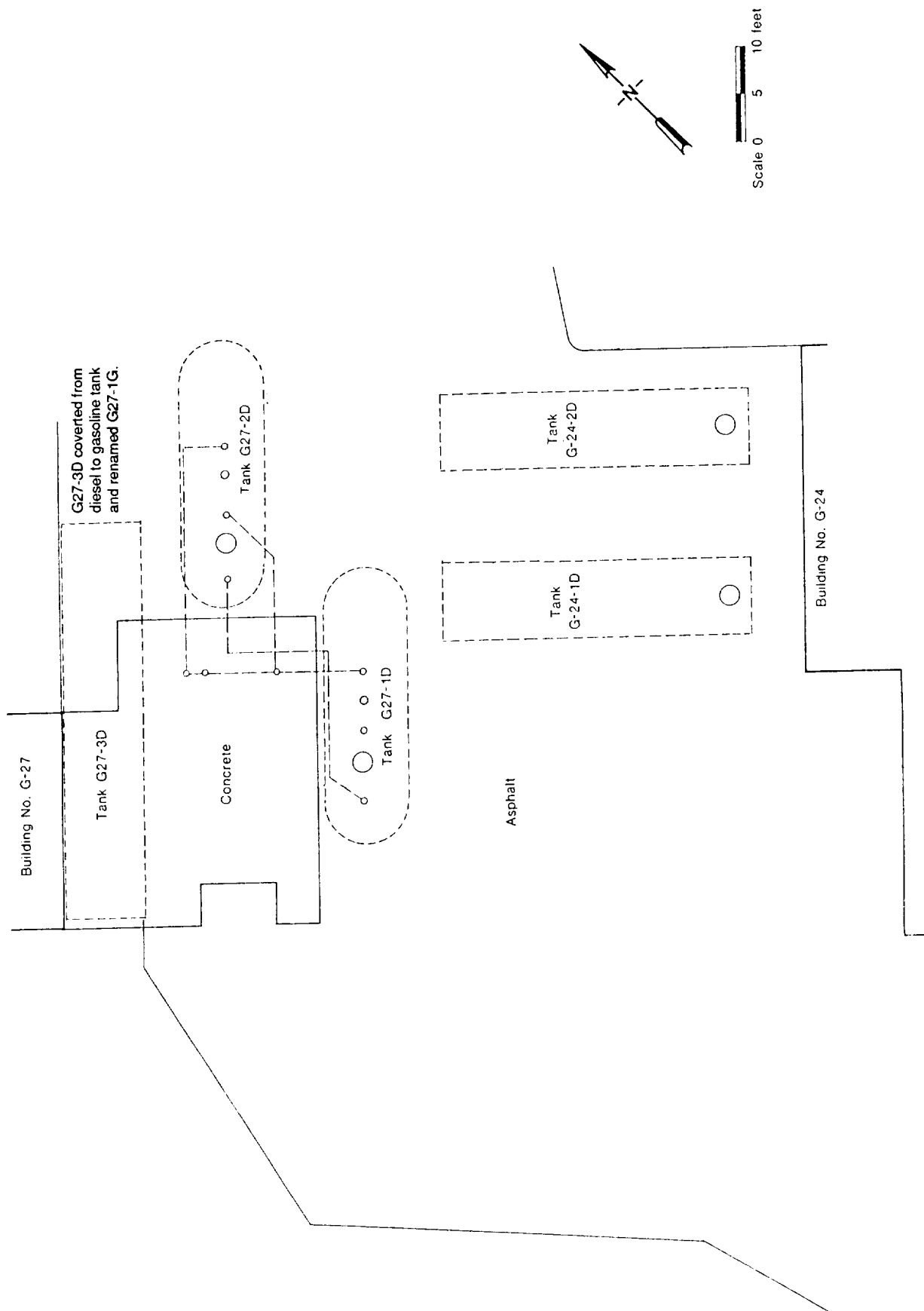


Figure 12. Echo Site: Details of Building G27 Area Showing Proximity of UST G27-3D to the Building

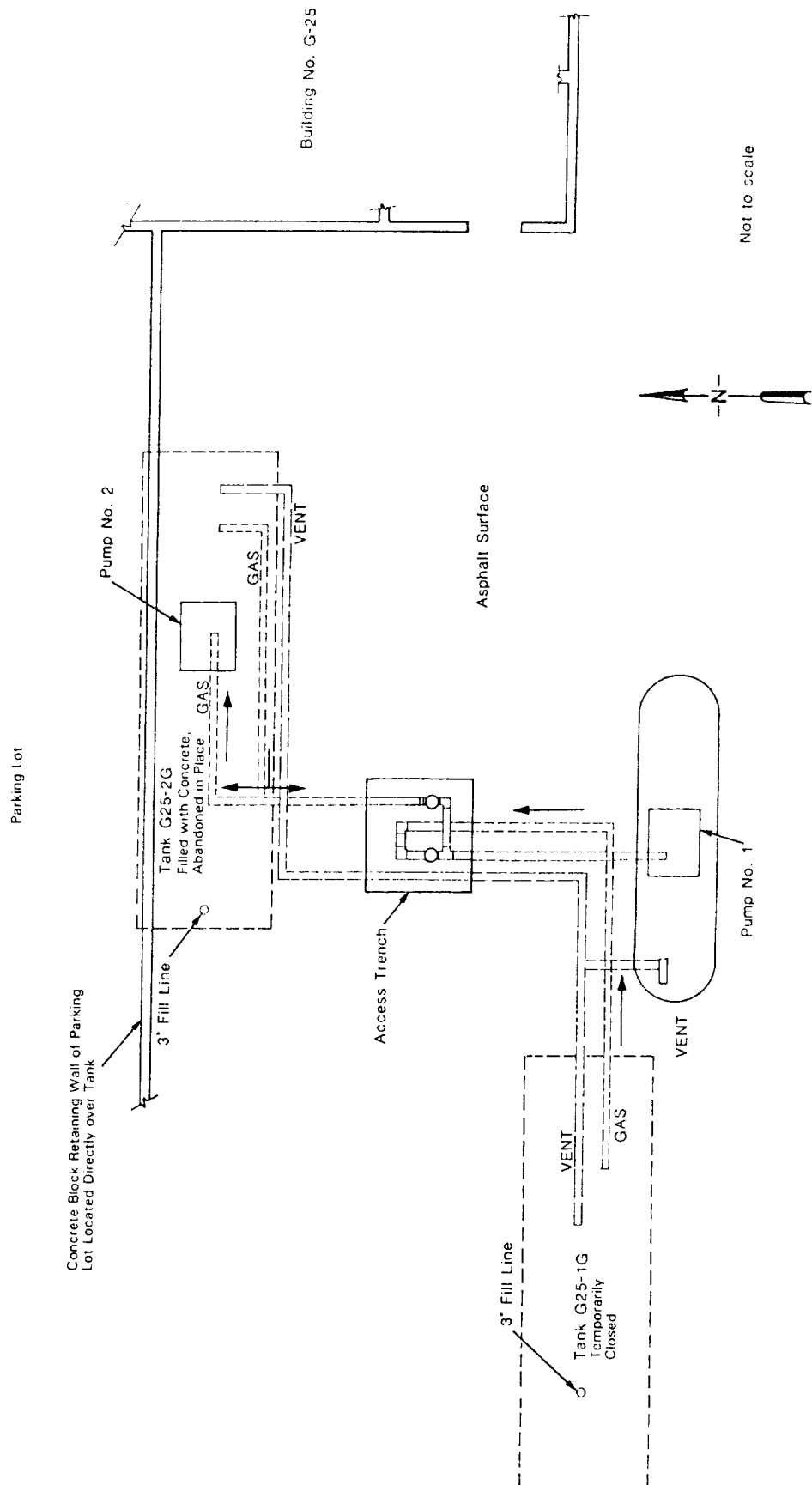


Figure 13. Echo Site: Details of Building G25 Area in 1987 Showing UST G25-2G Lying Directly under Parking Lot Retaining Wall

In 1989, both USTs were steam cleaned, inerted, exhumed, cut up as scrap, and the scrap hauled away from the GDSCC. The area from which the USTs had been removed was backfilled, compacted, and resurfaced with concrete.

The backfilling of the pit, from which G42-1G had been extracted, was delayed because the excavation evidenced some possible soil contamination. There was a definite odor of hydrocarbons, but the soil was not discolored. The action taken by the GDSCC, with respect to this soil contamination, will be treated in Volume 14, the next volume in this ongoing series of environmental projects at the GDSCC.

d. UST Group G24

This was a group of two, 12,000 gal, diesel-fuel tanks installed in 1973. The two tanks were located northwest of Bldg. G-24, the Generator Building. In 1986, both tanks passed the Horner leak test and were kept in service for the diesel-fueled electrical generators at the Echo Site.

In 1989, both USTs were steam cleaned, inerted, exhumed, and the two tank shells were hauled away from the GDSCC. The excavation to remove these two USTs is depicted in Figure 14.

The area from which the USTs had been removed was backfilled, compacted, and resurfaced with concrete.

e. UST Group TF

During the oil embargo experienced by the United States in 1973-74, these two, 12,000 gal, diesel-fuel tanks, USTs TF-3D and TF-4D, were installed as an emergency precaution. Neither tank was ever put into service. The two USTs were located along a dirt service road about 500 ft east of the Echo Site's Facility Service Yard (see Figures 10, 11, 15 and 16).

In 1986, both USTs passed a Horner leak test, but then were temporarily closed. In 1989, the two USTs were steam cleaned, inerted, exhumed, and the two tank shells were hauled away from the GDSCC. The area from which the USTs had been removed was backfilled and compacted, but no surface coating was added.

(2) Mars Site:

A generalized partial plot plan to permit the easy location of the major buildings at the Mars Site is depicted in Figure 17.

a. UST Group G81

This was a group of four, 12,000 gal, diesel-fuel tanks: two of them, G81-1DA and G81-1DB, were installed in 1965 and were fabricated of unprotected steel shells, while the other two, G81-2D and G81-3D, were installed in 1984 and were fabricated of protected fiberglass-coated steel shells.

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH

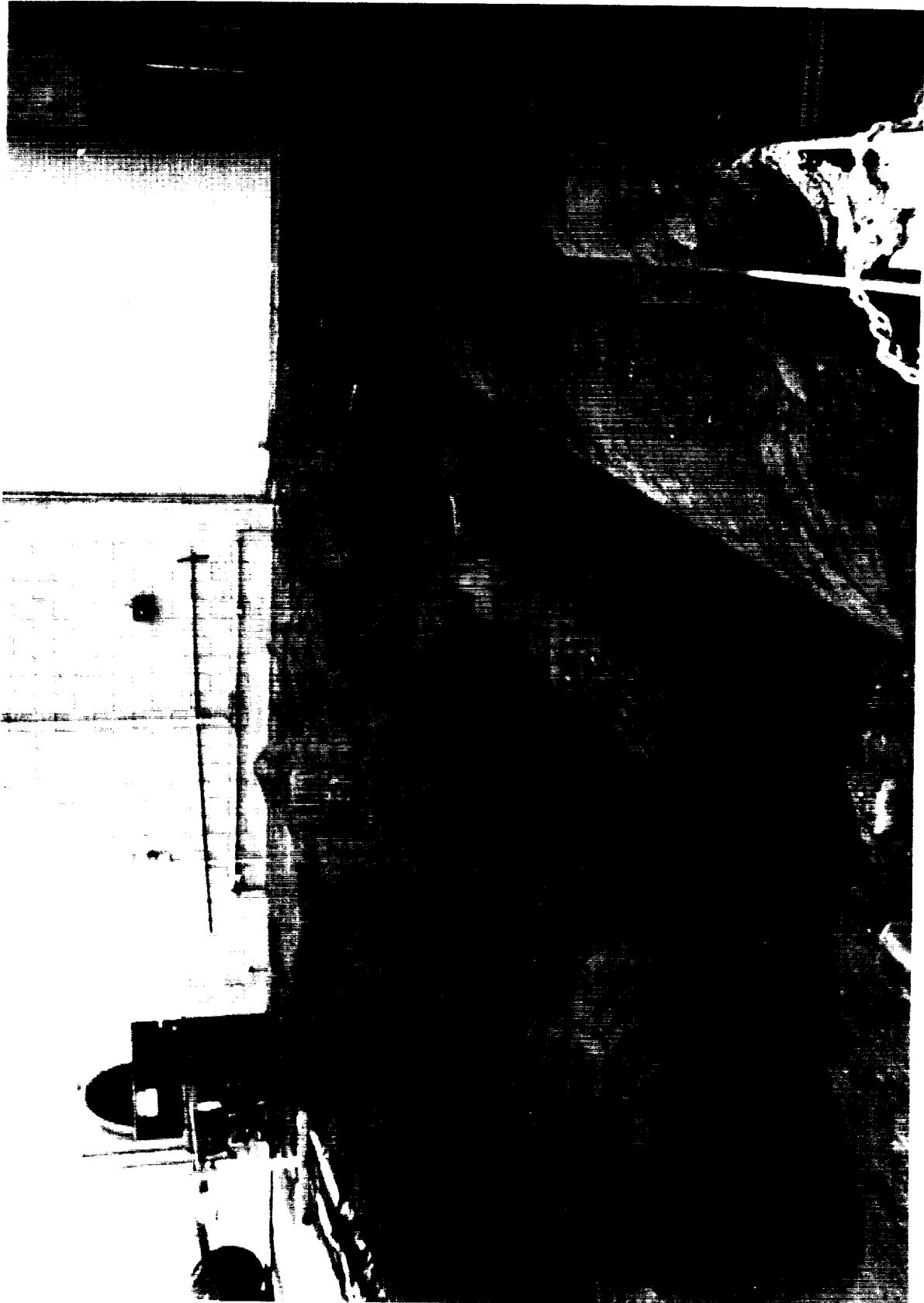


Figure 14. Echo Site: Excavation to Remove Two Old Diesel USTs near Bldg. G24, the Generator Bldg.

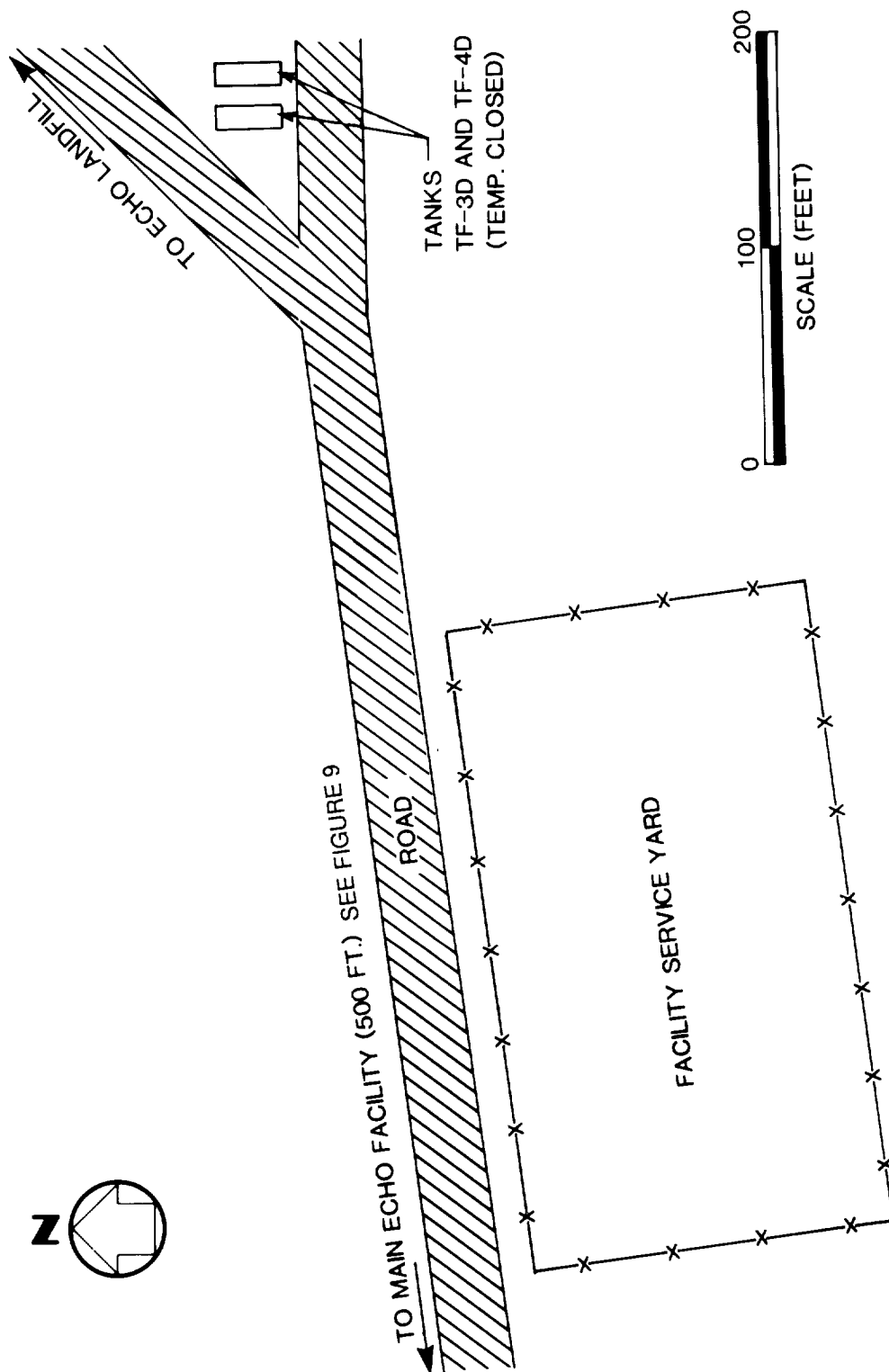
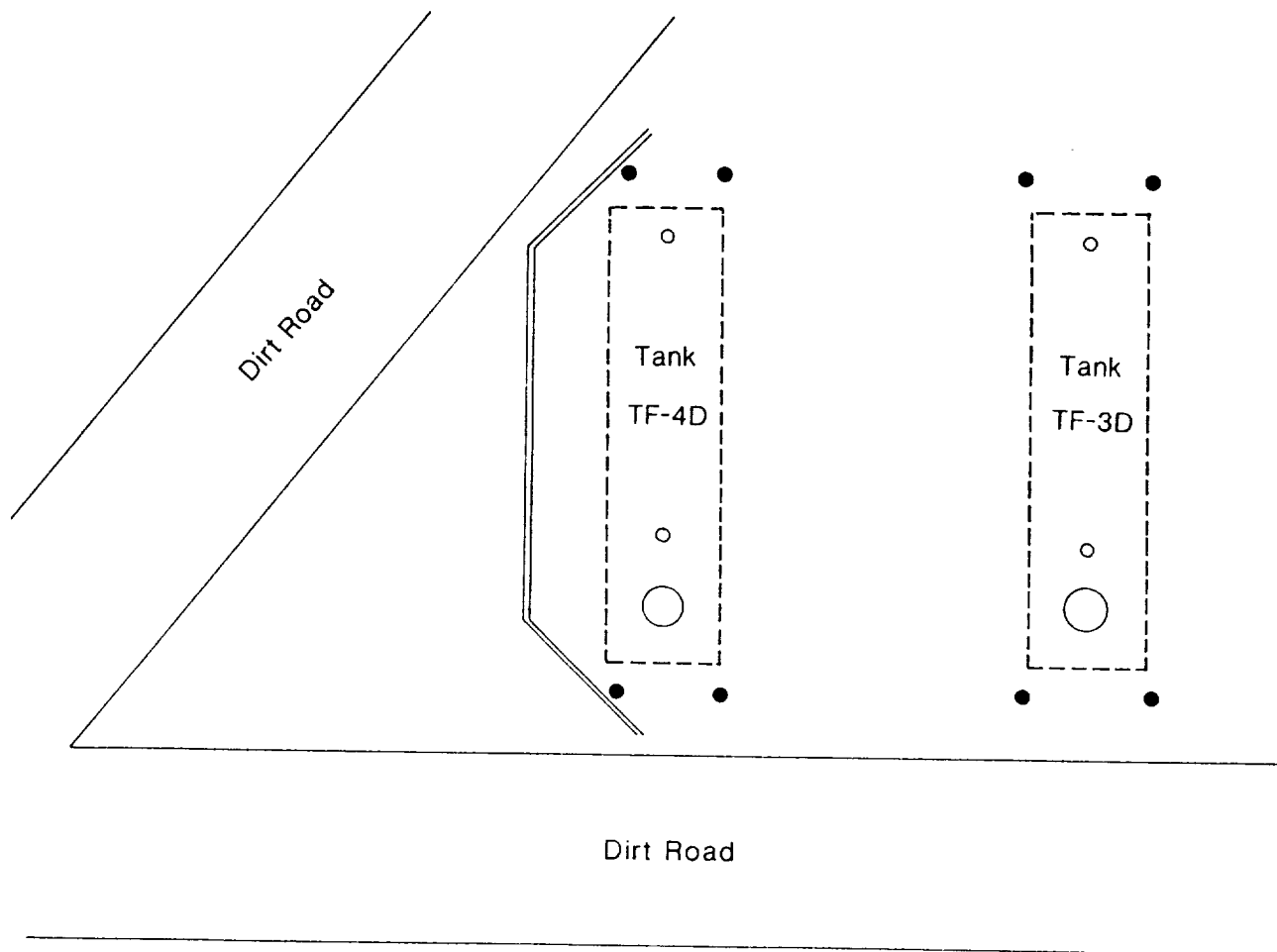
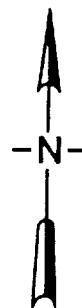


Figure 15. Echo Site: Location of USTs TF-3D and TF-4D in 1988, East of Main Echo Site Facilities



EXPLANATION

- Fill pipe or vent pipe
- Manhole cover
- Wooden guard posts
- == Guard rail



Scale 0 15 feet

Figure 16. Echo Site: Details of Diesel Fuel USTs TF-3D and TF-4D in 1988

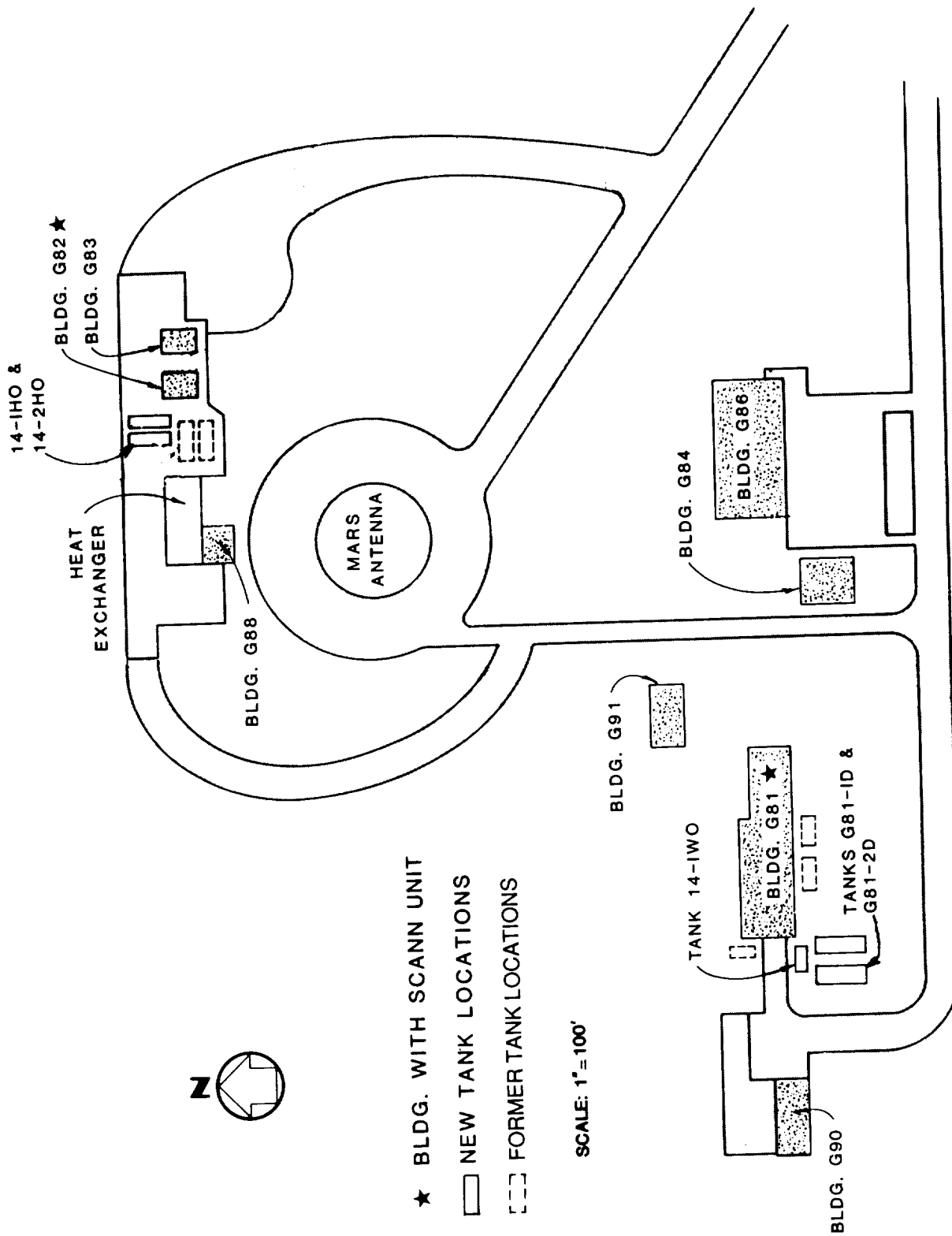


Figure 17. Mars Site: Generalized Partial Plot Plan to Easily Identify Major Building Locations

These four, diesel-fuel USTs were located in two groups of two USTs each to the south and southwest of Bldg. G-81, the Generator Building at the Mars Site.

In December 1986, USTs G81-2D and G81-3D passed the Horner leak tests and were kept in service until 1989 when they were steam cleaned, inerted, exhumed, and the two tank shells were hauled away from the GDSCC. The pit from which these two USTs were removed was not backfilled, but was expanded and shaped to receive the two, new, diesel-fuel tanks designated G81-1D and G82-2D (see Section V). With the removal of the two old USTs, the tank-designation UST G81-3D ceased to exist at the GDSCC.

In January 1987, USTs G81-1DA and G81-1DB passed the Horner leak tests but had to have their piping leaks repaired. After the repair work, the two USTs were kept in service until 1989. Because the removal of these two USTs could have resulted in damage to the adjacent generator building, Bldg. G-81, it was decided to steam clean, inert, and fill the two USTs with concrete slurry and abandon them in place. Thus, two USTs are abandoned in place at the Mars Site as well as two abandoned USTs at the Echo Site. The partial excavation of USTs G81-1DA and G81-1DB is shown in Figure 18.

b. UST 14-1W0

This UST was a 920 gal tank installed in 1973 that was used to store waste oil from the diesel generators in Bldg. G81. It was located northwest of the building (see Figure 17). In December 1986, this UST passed a Horner leak test and was kept in service.

In 1989, UST 14-1W0 was emptied, steam cleaned, exhumed, and the tank shell was hauled away from the GDSCC. The area from which the UST had been removed was backfilled, completed, and resurfaced with concrete.

c. Hydraulic Oil USTs

Two 10,000 gal USTs installed in 1971, USTs 14-1H0 and 14-2H0, were used to store hydraulic oil needed for the operation of the Mars antenna (DSS 14). Both USTs, located northeast of the antenna (see Figures 17 and 19), passed their Horner leak tests in 1986 and were kept in service.

In 1989, both USTs were emptied, steam cleaned, degassed, exhumed, and the two tank shells were hauled away from the GDSCC. The area from which these two USTs had been removed was backfilled, compacted, and resurfaced with concrete.

(3) Mojave Base Site:

A generalized plot plan, depicting the various buildings and USTs as they were at the Mojave Base Site in 1987, is shown in Figure 20.

a. UST Group M9

This group consisted of four USTs, three to store diesel fuel and one to store waste oil from diesel generators. The three diesel-fuel USTs, each of 24,000 gal capacity, were installed in 1964 and were designated M9-1D, M9-2D, and M9-3D. The single waste oil UST, of 500 gal capacity, was used to

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



Figure 18. Mars Site: Partial Excavation of USTs G81-LDA and G81-LDB
Adjacent to Generator Building G81

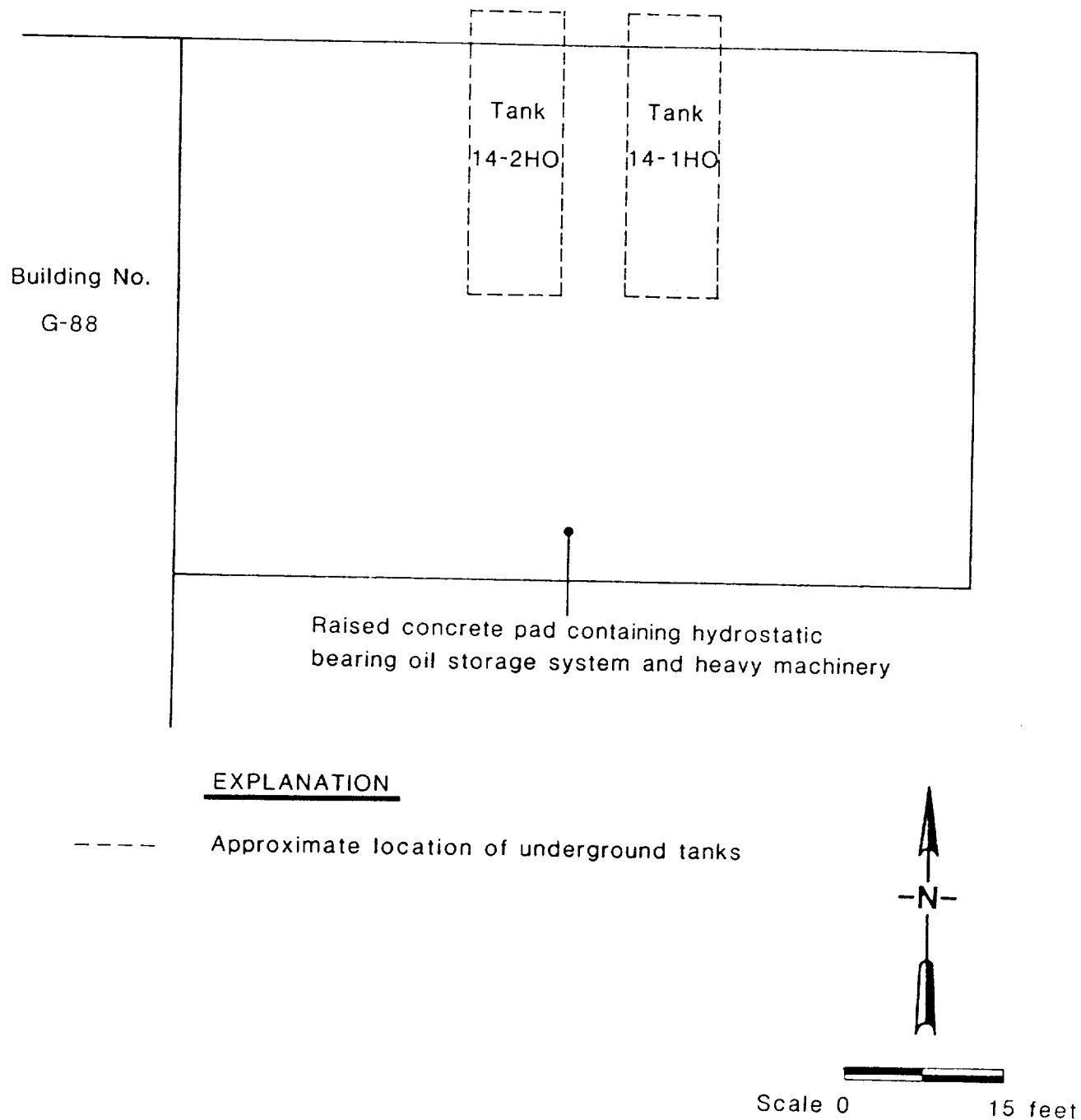


Figure 19. Mars Site: Hydraulic Oil USTs 14-1HO and 14-2HO Near Bldg. G88
Northeast of the Mars Antenna

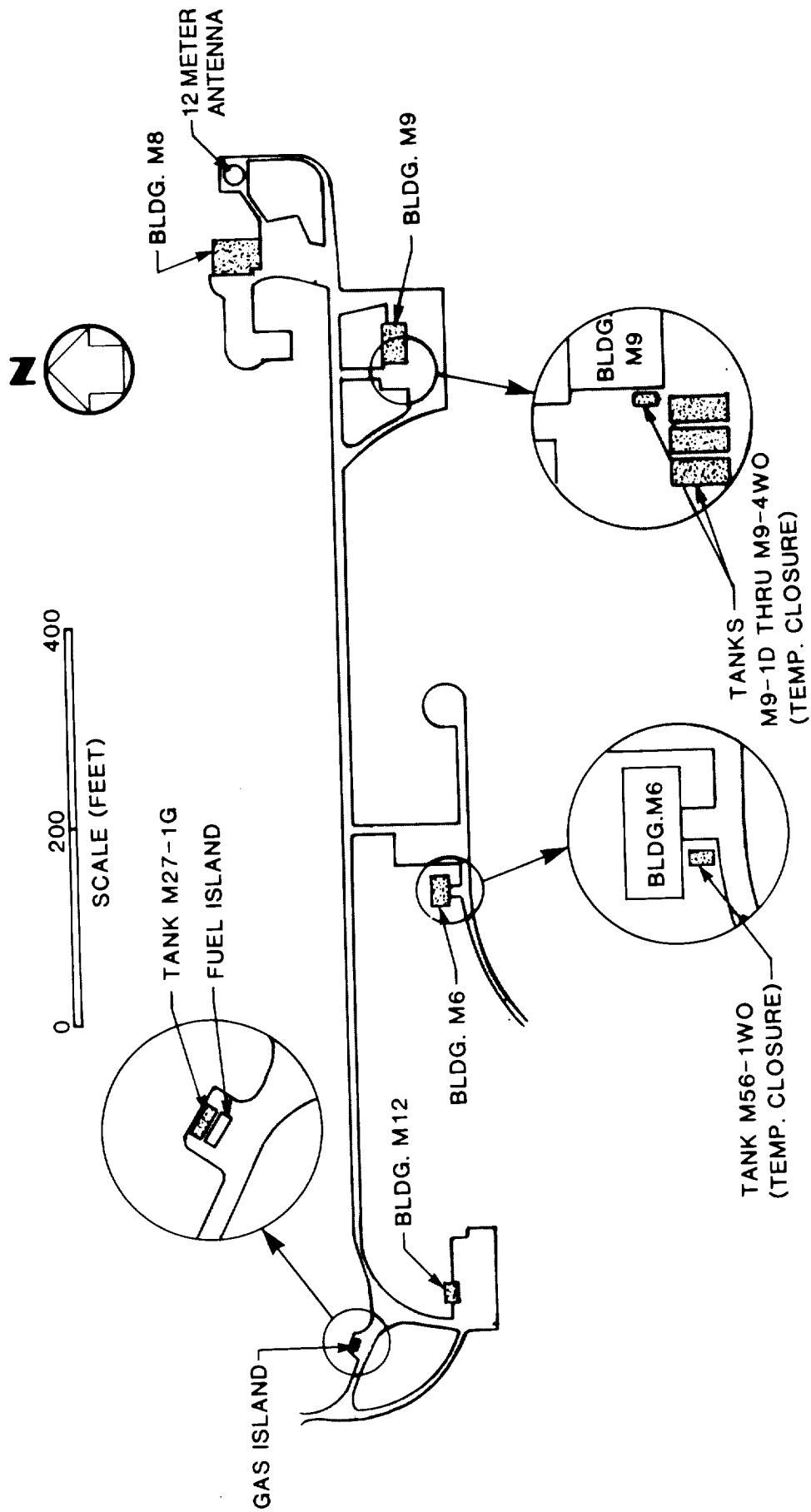


Figure 20. Mojave Base Site: Generalized Plot Plan Depicting Buildings and USTs as they were in 1987

store used crankcase lubrication oil collected from the diesel generators housed in Bldg. M9. This smaller UST also was installed in 1964 and was named M9-4W0. The four USTs were located southwest of Bldg. M9, the generator building at the Mojave Base Site (see Figure 20). A detailed drawing of the area that housed the four USTs near Bldg. M9 is shown in Figure 21.

In December 1986, the four USTs were Horner-tested for leaks. UST M9-1D passed the test and it was kept in service. The piping associated with M9-2D and M9-3D failed to pass the leak test. UST M9-4W0, however, passed the Horner test. The latter three USTs, M9-2D, M9-3D and M9-4W0, were emptied and sealed for temporary closure.

In 1989, the three USTs M9-1D, M9-2D and M9-3D were steam-cleaned, degassed, exhumed, and the three tank shells were hauled away from the GDSCC. The exhumation of a diesel tank and the waste oil tank is shown in Figure 22.

The area from which USTs M9-1D, M9-2D, and M9-3D had been removed was backfilled, compacted and resurfaced with concrete. The backfilling of the pit, from which UST M9-4W0 had been exhumed, however, was delayed because the excavation revealed some soil contamination. The action taken by the GDSCC, with regard to this soil contamination will be treated in Volume 14, the next volume in this ongoing series of environmental projects at the GDSCC.

The UST M9-4W0 tank shell was cut up as scrap metal at the GDSCC and the scrap was hauled away.

b. UST M56-1W0

UST M56-1W0, located southwest of Bldg. M6, the Telemetry Building (see Figure 20), was a 7,500 gal UST installed in 1964 and used to store waste oil. In 1986, the UST passed a Horner leak test and was emptied and sealed for temporary closure.

In 1989, UST M56-1W0 was steam cleaned, degassed, exhumed, cut up as scrap metal at the GDSCC, and the scrap was hauled away. The pit from which the UST had been removed was backfilled, compacted, and resurfaced with concrete.

c. UST M27-1G

Located at the western edge of the Mojave Base Site Road, UST M27-1G was a 4,000 gal tank that had been installed in 1960 (see Figure 20). It supplied unleaded gasoline for the fuel dispensing island at the Mojave Base Site (Figure 23). In 1986, it passed a Horner leak test and was kept in service.

In 1989, it was decided to move the fuel dispensing island eastward closer to Bldg. M8, the Operations Bldg. next to the NOAA antenna. Thus, UST M27-1G was emptied, steam cleaned, degassed, exhumed, and the tank shell was hauled away from the GDSCC. The excavation from which the UST and the fuel dispensing island had been removed was backfilled, compacted, and resurfaced with concrete.

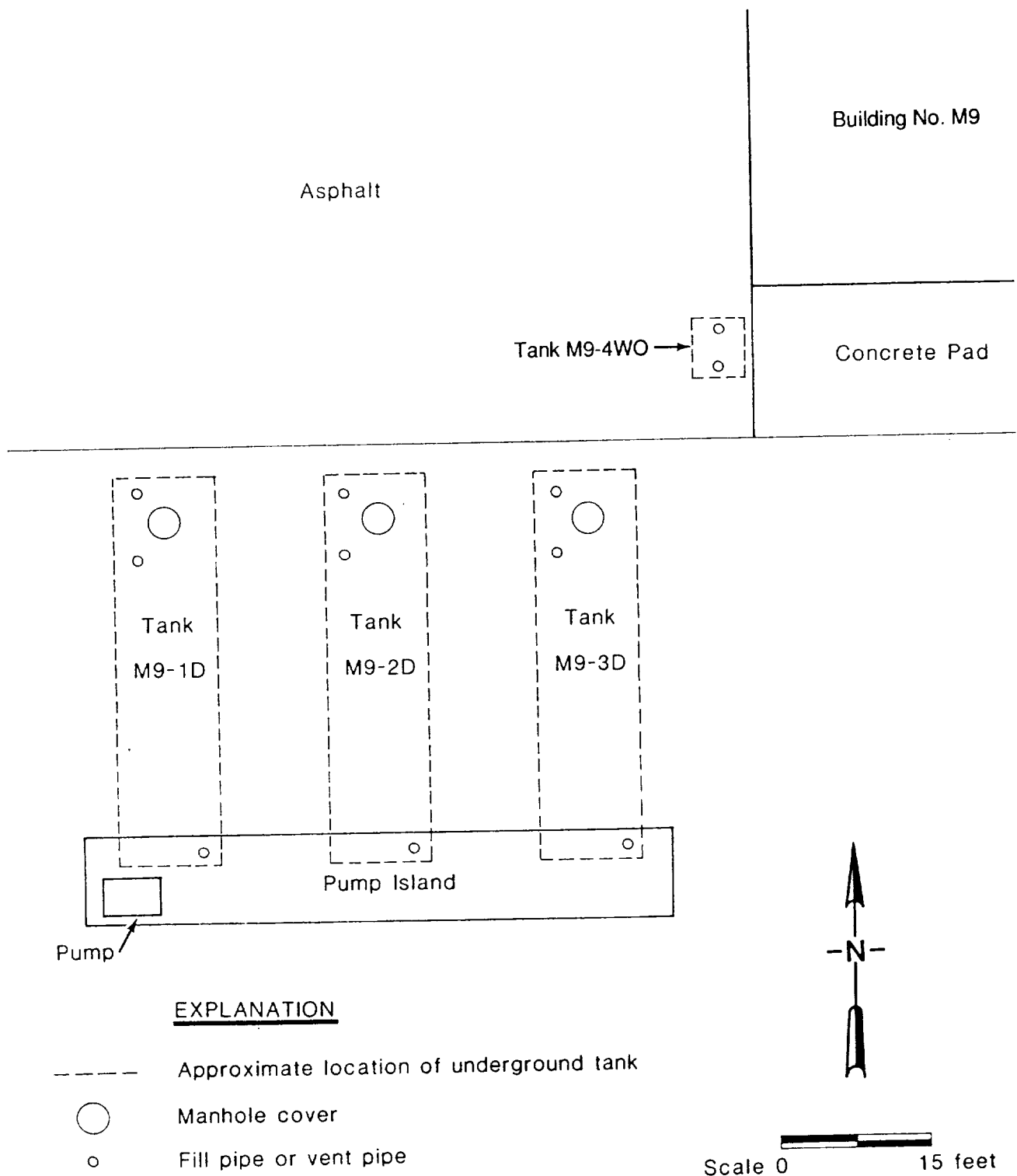
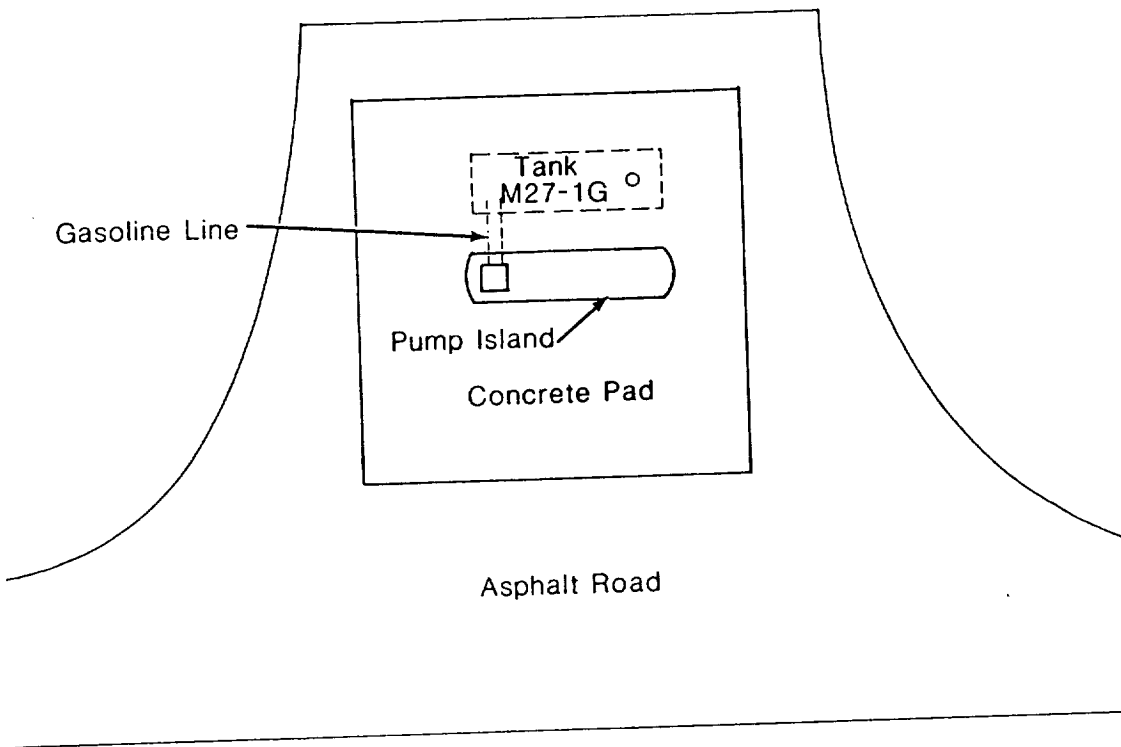


Figure 21. Mojave Base Site: Detailed Drawing of the Area that Housed the Four M9 USTs near Bldg. M9

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



Figure 22. Mojave Base Site: Exhumation of an M9 Diesel UST and the M9-4W0 Waste Oil Tank



EXPLANATION

- Approximate location of underground tank
- Gasoline dispenser pump

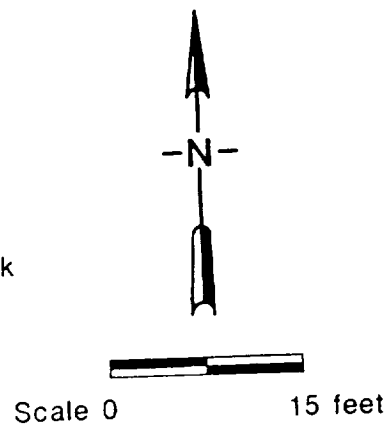


Figure 23. Mojave Base Site: UST M27-1G Stored Supply of Unleaded Gasoline for Fuel Dispensing Island

(4) Apollo Site:

A generalized partial plot plan, depicting some of the buildings and two USTs as they were at the Apollo Site in 1987, is shown in Figure 24.

The two USTs that were at the Apollo Site belonged to UST Group A1. Both USTs were located south of Bldg. A1, the Operations Building, both stored unleaded gasoline, and both were installed in 1964. A more detailed drawing of the geographical relationship between Bldg. A1 and the USTs A1-1G and A1-2G is shown in Figure 25.

The two A1 USTs were not of equal capacity; A1-1G could hold 4,000 gal, while A1-2G had a capacity of 7,500 gal.

In 1986, both USTs were Horner tested for leaks. UST A1-1G passed the test, but the piping associated with A1-2G failed. Both USTs were emptied, steam cleaned, degassed, and sealed for temporary closure. The steam-cleaning apparatus used in the cleaning of the Apollo Site USTs is shown in Figure 26.

In 1989, both A1 USTs were exhumed, cut up as scrap metal at the GDSCC, and the scrap was hauled away. The respective pits from which the two USTs had been removed were backfilled, compacted, and resurfaced with concrete.

(5) Goldstone Dry Lake Airport Site:

A generalized plot plan of the Goldstone Dry Lake Airport as it was in 1987 is depicted in Figure 27.

The single UST at the airport, designated G71-1, was a 2,000 gal tank that held aviation fuel. It was located northwest of Bldg. G-71, the former Airport Terminal Building, and it was installed in 1966.

In December 1986, UST G71-1 passed a Horner leak test and then was emptied, cleaned, degassed, and sealed for temporary closure. In 1989, UST G71-1 was exhumed, cut up as scrap metal at the GDSCC, and the scrap was hauled away. The pit from which the UST was extracted was backfilled and compacted but not covered with any surface coating.

In addition to UST G71-1, the 2,000 gal underground storage tank, the airport also had a 100 gal, aboveground tank for the storage of aviation fuel. It also was emptied, steam cleaned, degassed, cut up as scrap metal at the GDSCC, and the scrap was hauled away.

E. GENERAL: CLEANING OF THE USTs

The cleaning of the USTs at the GDSCC and the testing for any residual explosive gases remaining with a GX3 Gas & Oxygen Monitor, was carried out by Cleaning and Pumping Specialists, Inc., Signal Hill, California, 90806. The cleaning records for all USTs and the calibration of the GX3 Gas & Oxygen Monitor are presented in Appendix B.

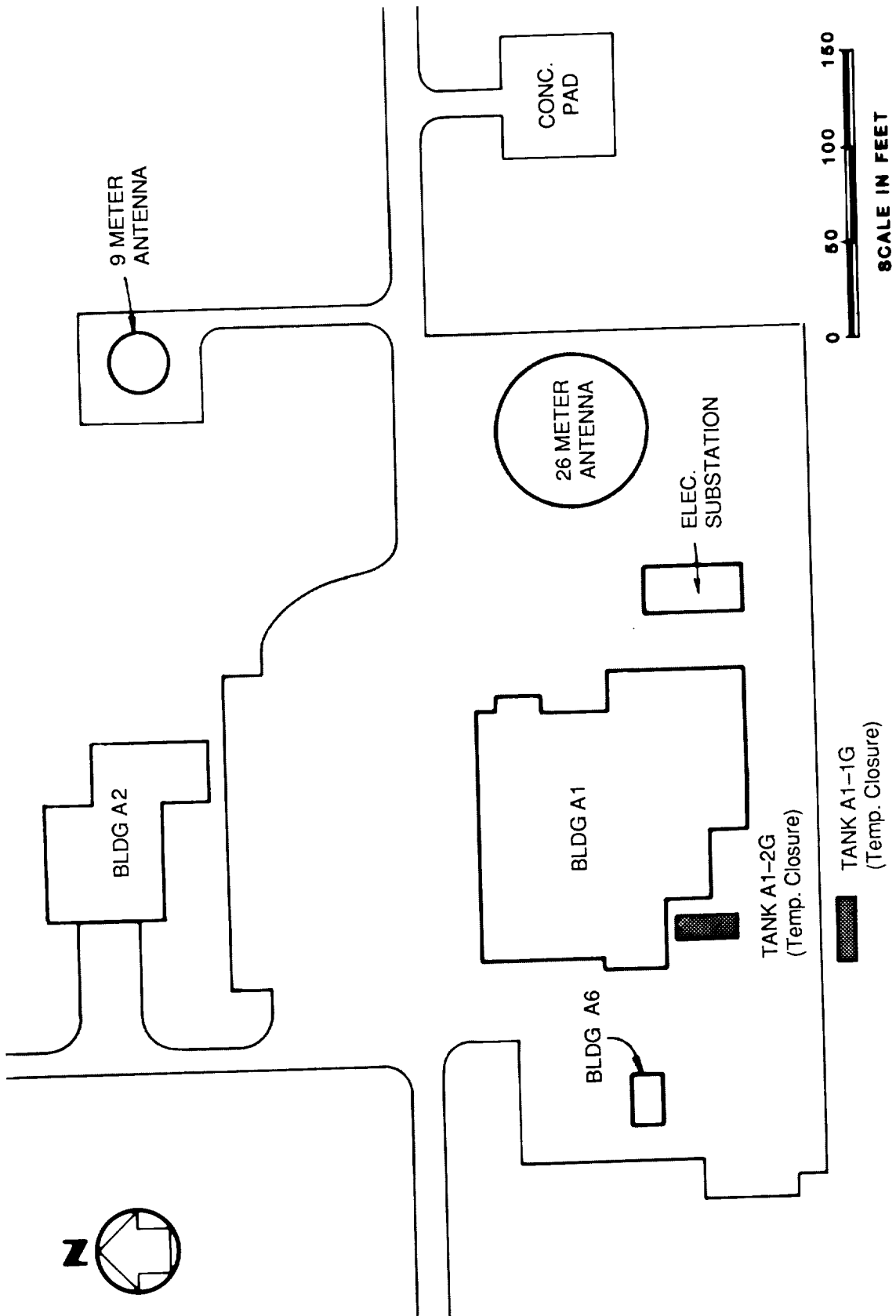


Figure 24. Apollo Site: Generalized Partial Plot Plan Depicting Some Buildings and Two USTs as they were in 1987

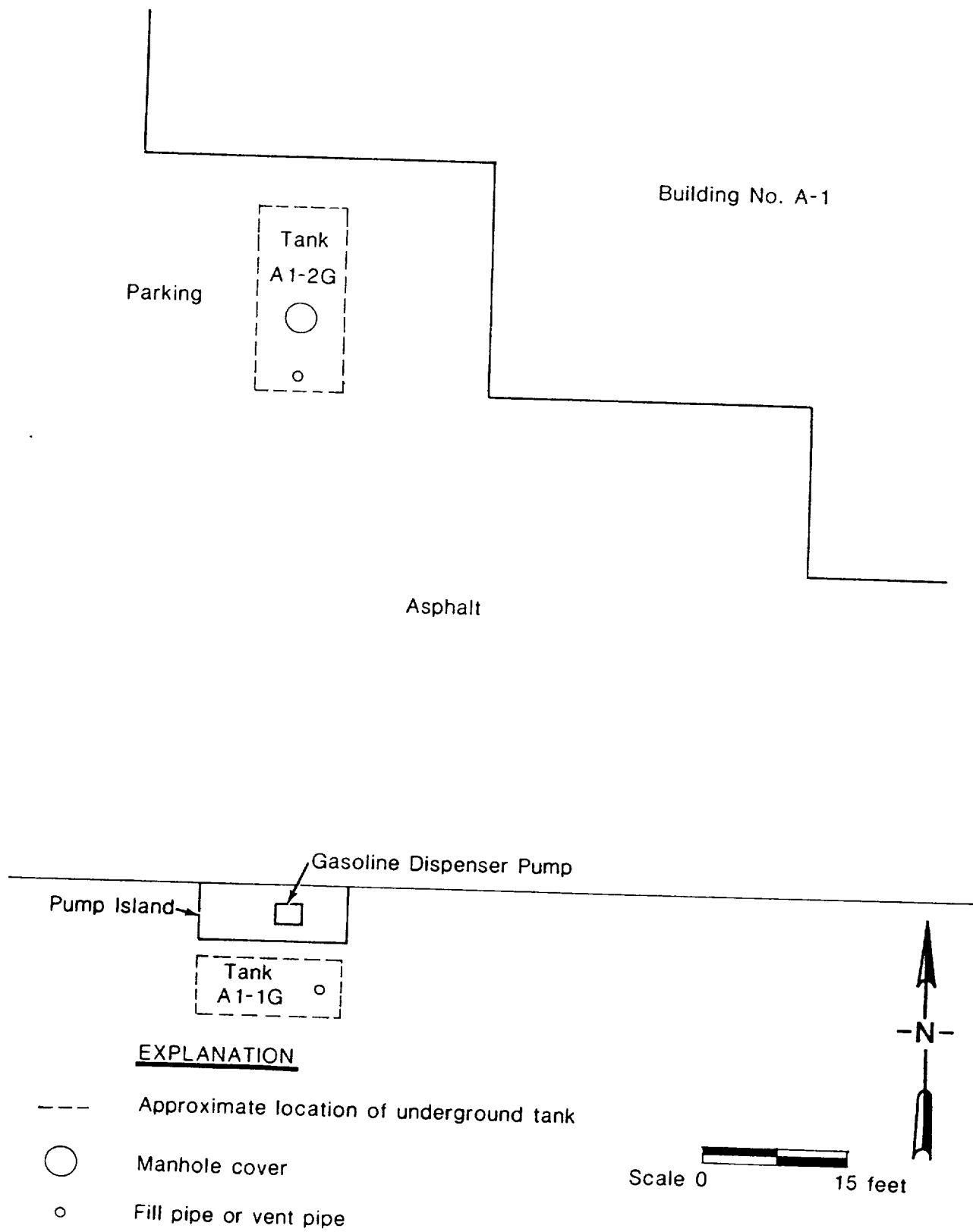


Figure 25. Apollo Site: Geographical Relationship Between Bldg. A1 and USTs A1-1G and A1-2G

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



Figure 26. Apollo Site: Typical Steam Cleaning Equipment Used for
Cleaning of Tank Before Tank is Inerted and Sealed

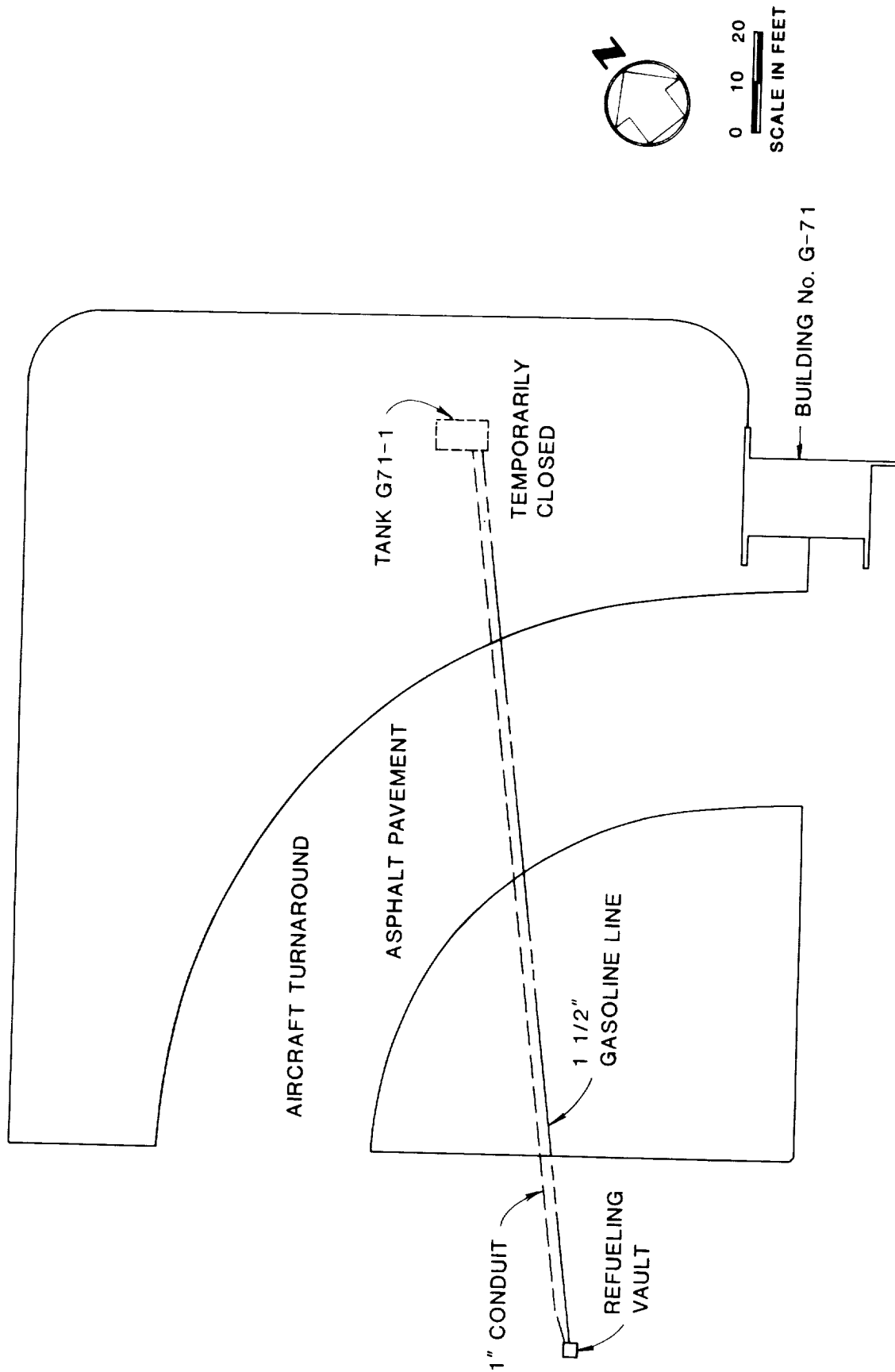


Figure 27. Goldstone Dry Lake Airport: Generalized Plot Plan as it was in 1987

Table 3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC*

1988

- 19 Dec. Mars Site: Contractor began to empty and disconnect Underground Storage Tanks (USTs) and to break up concrete slabs of USTs G81-2D, G81-3D, 14-1H0 and 14-2H0. The new UST that is to replace G81-3D will now be designated as G81-1D.
- 20 Dec. Mars Site: As precaution not to damage any possible underground electrical cables, 14-1H0 and 14-2H0 USTs were excavated by hand. Concrete-slab tops of USTs were broken up with jackhammers.
- 21 Dec. General: Engineering-Science (E-S) provided the Contractor with a list of existing USTs at the GDSCC, with information about each tank's capacity and physical dimensions. At request of personnel of San Bernardino County/Department of Environmental Health Services (SBC/DEHS), E-S asked the Contractor to supply information to the County concerning the Vapor Recovery System (VRS) to be used in emptying USTs.
- 22 Dec. General: E-S informed Contractor that permit for the VRS will be processed by San Bernardino County and that the GDSCC will acquire it from the County for the GDSCC environmental department.
- 28 Dec. Echo Site: Existing pavement and curbs at the General Services Administration (GSA) Fuel Dispensing Station (FDS) No. 1 were cut and demolished.
- Mojave Base Site (MBS): Saw cut and demolished existing pavement at GSA/FDS #3 (UST M27-1G).
- Mars Site: Barricaded demolition work area at site of USTs 14-1H0 and 14-2H0.
- 29 Dec. MBS: Hand-excavated top cover and broke up existing asphalt pavement at USTs M9-4W0 and M56-1W0.
- Apollo Site: Hand-excavated top cover of UST A1-2G.

1989

- 3 Jan. MBS: Subbase earthwork of pavement adjacent to USTs M9-4W0 and M56-1W0 was scarified, mixed, and compacted.
- Apollo Site: Exploratory excavation began around USTs A1-1G and A1-2G.

*This chronology is based upon Daily Field Reports written by Engineering-Science, Inc., Pasadena, California, the Resident Engineer that represented JPL in this Environmental Project at the GDSCC.

Table 3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC (Cont'd)

- 5 Jan. General: E-S requested a revision of the UST replacement schedule after the delivery dates of the replacement USTs were confirmed.
- 9 Jan. Apollo Site: Sawed apart concrete pad atop UST A1-2G.
- Mars Site: Broke up concrete pads atop USTs G81-3D and G81-2D.
- General: E-S asked the Contractor to provide a schedule to San Bernardino County personnel for the removal of USTs from Goldstone.
- 10 Jan. Echo Site: Demolished concrete pads atop USTs G27-1G, G27-2D, and G27-3D.
- MBS: Removed and demolished the covers atop USTs M9-1D, M9-2D, M9-3D and M56-1W0. Broke up the concrete island atop UST M27-1G, the tank of GSA/FDS No. 3.
- Mars Site: Completed demolition and removal of covers of USTs G82-2D and G81-3D.
- Airport Site: Broke up concrete pad atop UST G71-1.
- General: E-S processed permits for excavation of five USTs.
- 12 Jan. Echo Site: Installed concrete pouring forms for new GSA/FDS No. 1.
- Mars Site: Cleaned hydraulic tanks 14-1H0 and 14-2H0, and diesel tanks G81-2D and G82-3D.
- MBS: Constructed forms for concrete slab at new GSA/FDS #3. Dismantled and removed the old FDS.
- General: Jenkin Construction Co. (Contractor) and GDSCC personnel met to discuss schedule for removal of old USTs and installation of new tanks. Because standby diesel tanks are available for the electrical generating plant at the Echo Site, the GDSCC agreed to accept a 4,800 gal capacity tank instead of an 8,000 gal tank as called for in Change Order #3 specifications.
- 13 Jan. Echo Site: Cleaned inside of USTs G27-2D and G27-3D. Cut and prepared wooden forms for concrete slabs, and prepared holes for the island piers of GSA/FDS #1.
- MBS: Continued excavation of USTs M9-1D, M9-2D, M9-3D, M9-4W0 and M56-1W0 and the dismantling of their piping systems. Began cleaning of interiors of USTs M9-1D and M9-2D.
- General: Conducted compaction tests of subgrade of proposed pavements at GSA/FDS #1 at the Echo Site and GSA/FDS #3 at MBS.

Table 3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC (Cont'd)

- 14 Jan. Airport Terminal: Cleaned interiors of UST G71-1, and G70-1, the aboveground tank. GDSCC and Security personnel agreed to allow tank-cleaning crews to work today (Saturday).
- 16 Jan. Echo Site: Began to uncover USTs G27-1G, G27-2D, G27-3D, G42-1D, G42-2D and G25-1G. The concrete slab of GSA/FDS #2 (Heavy Equipment fuel dispensing station east of Bldg. G-42) was broken up and the station was dismantled. The outside pipe at Bldg. G-24 and the connections to G24-1D and G24-2D were exposed to permit transfer of their diesel fuel contents to a standby, trailer-mounted tank of 4,800 gal capacity that was delivered to the Bldg. G-24 site.
- Apollo Site: USTs A1-1G and A1-2G were uncovered.
- 17 Jan. Echo Site: Continued excavation and dismantling of piping of USTs G27-2D, G27-3D, G42-1D and G25-1G. UST G27-1G will be kept active as a gasoline dispensing tank until the new GSA/FDS #1 is completed and ready to function. Resumed construction of wooden form for concrete pouring at GSA/FDS #1.
- MBS: Continued cleaning of insides of USTs M9-1D and M9-2D.
- General: Schedule for UST removals was submitted by the Contractor.
- 18 Jan. Echo Site: To get access to and to facilitate the removal of USTs G27-2D and G27-3D, dirt that was adjacent to the open excavations of USTs G27-2D and G27-3D was moved to an open area between Bldgs. G-24 and G-28.
- MBS: Cleaned the interiors of USTs M9-3D, M9-4W0 and M56-1W0. Set wooden forms for the concrete slab at the new GSA/FDS #3.
- Mars Site: Excavated around USTs G81-2D and G81-3D.
- 19 Jan. Echo Site: Fill dirt from an approved pit from excavations at the Evaporation Pond was hauled to various UST sites to fill in the pits that are left after USTs are extracted from underground.
- MBS: Uncovered USTs M9-1D, M9-2D and M9-3D.
- Apollo Site: Cleaned insides of USTs A1-1G and A1-2G.
- Airport Terminal: Uncovered UST G71-1. G70-1 is an aboveground storage tank.
- 20 Jan. Echo Site: Completed cleaning of insides of tanks G25-1G, G42-1D, G42-2D, TF-3D and TF-4D.
- Mars Site: Began to shore up work area adjacent to USTs 14-1H0 and 14-2H0

Table 3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC (Cont'd)

- General: E-S and the GDSCC Safety Office issued fire permits for each UST site. The GDSCC Safety Office requested that Lower Explosive Level (LEL) tests be conducted on each removed UST before torches are used to cut up the tank.
- 23 Jan. MBS: USTs M9-1D, M9-2D, M9-3D, M9-4W0 and M56-1W0 were removed from the ground and were begun to be cut apart.
- Apollo Site: USTs A1-1G and A1-2G were removed from the ground.
- Mars Site: Uncovered USTs 14-1H0 and 14-2H0.
- General: San Bernardino County Environmental Health Inspector visited the GDSCC tank sites to inspect the excavations after USTs were removed. Soil samples were collected from beneath the excavated tanks to test for any possible soil contamination.
- 24 Jan. Apollo Site: Began to backfill holes that remained after USTs A1-1G and A1-2G were exhumed.
- Airport Terminal: UST G71-1 was excavated to be cut up into scrap metal. UST G70-1, the aboveground storage tank, also was to be cut up.
- Mars Site: USTs G81-2D, G81-3D, 14-1H0 and 14-2H0 were pulled out of the ground.
- General: At a meeting involving GDSCC management, E-S personnel, and the Jenkin Construction Co., the GDSCC gave the Contractor permission to backfill the holes created by the excavations of the USTs. But this backfilling could take place only AFTER any apparently contaminated soil samples were first set aside for testing as required by San Bernardino County. This decision was made because it takes at least two weeks for the testing laboratory to provide soil-test results.
- 25 Jan. Echo Site: USTs G27-2D, G27-3D, G25-1G, G42-1G, and G42-2D were exhumed.
- MBS: Began backfilling of holes that remained from excavation of tanks.
- Apollo Site: Began backfilling of holes that remained from excavation of tanks.
- 26 Jan. Echo Site: Continued backfilling and compaction of excavated areas, torch cutting of the exhumed tanks, and removal of the cut-up tank debris from the GDSCC. E-S reminded the Contractor to pave over the areas that were backfilled. A compaction test will be conducted before paving is begun. Odor of soil removed in the excavation of UST G42-1G indicates the soil may have been

Table 3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC (Cont'd)

contaminated by tank leakage. After consultation with GDSCC management, E-S instructed the Contractor to pile removed soil onto a paved area. This soil will be removed after consultation with SBC/DEHS personnel.

MBS: Odor of soil removed in excavation of UST M9-4W0 indicates the soil may have been contaminated. The same procedure was followed as described for UST G42-1G at Echo Site (see immediately above).

27 Jan. Echo Site: Contractor expanded the excavated area from which UST G42-1G was removed. Soil samples were taken for analyses.

MBS: To determine the extent of any soil contamination, the GDSCC arranged to have test borings drilled into the hole remaining after removal of UST M9-4W0.

General: Continued backfilling and compaction at sites after removal of USTs from Echo, Apollo, Mojave Base Station and Airport Sites. Continued hauling away pieces of cut-up, scrapped tanks.

30 Jan. Echo Site: At the request of the GDSCC Environmental Office, E-S instructed the Contractor to spread out the possibly contaminated soil exhumed in the removal of UST G42-1G. The excavated area also was expanded to remove any additional possibly contaminated soil.

Mars Site: Excavated area from which diesel USTs had been removed were expanded in size and shape to accommodate the installation of the new diesel replacement tanks, G81-1D and G81-2D.

General: Continued hauling away of pieces of cut-up, scrapped tanks and piping out of the GDSCC.

31 Jan. MBS: Excavation begun to install the new M8-1G UST.

1 Feb. Echo Site: Backfilled the excavations and compacted the soils at sites from which USTs TF-3D and TF-4D had been removed.

2 Feb. General: Work stopped at 11:30 a.m. because of strong gusty winds.

3 Feb. General: Work stopped at 10:00 a.m. because of powerful wind gusts.

6 Feb. Mars Site: Work began on the route and piping running between the electrical generators in Bldg. G-81 and the site for the new diesel fuel USTs.

Table 3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC (Cont'd)

- 7 Feb. MBS: Trenching and laying out of underground electrical conduits were carried out between Bldg. M-12 and the site for the new GSA/FDS No. 3 (UST M8-1G). Excavated route then was backfilled and compacted.
- 8 Feb. General: California Highway Patrol closed the road between Barstow and the GDSCC because of severe weather conditions (heavy snowfall). Fort Irwin, entry to the GDSCC, closed its gates to traffic. No construction activities today.
- 9 Feb. Mars Site: Continued work on fuel-oil supply and return lines leading to electrical generators inside Bldg. G-81.
- 10 Feb. General: The GDSCC received delivery of the following new USTs: 14-1H0, 14-2H0 and 14-1W0 for the Mars Site, and G42-1D for the Echo Site.
- 13 Feb. Echo Site: Trenching and laying out of underground electrical conduits between Bldg. G-24 and new GSA/FDS No. 1.
- Mars Site: Final excavation and embedment procedures to receive the two new 14-1H0 and 14-2H0 replacement USTs.
- General: E-S instructed Contractor to remove all dead electrical wires left in any abandoned conduits after old USTs and fuel dispensers were removed.
- 14 Feb. Mars Site: In the presence of GDSCC representatives and inspectors from the SBC/DEHS, personnel of Joor Manufacturing, Inc., Escondido, California, tested the new tanks 14-1H0 and 14-2H0 for integrity of tanks' outer coatings (Holiday test). The excavation and embedment for the two new tanks also were inspected before the tanks were lowered into place. The excavation then was backfilled with pea gravel to ensure complete burial of the tanks beneath the pea gravel. Continued preparation of excavation to receive the new G81-1D and G81-2D USTs.
- 15 Feb. Mars Site: New replacement tanks for USTs G81-1D and G81-2D arrived at the GDSCC.
- 16 Feb. Mars Site: Prepared USTs 14-1H0 and 14-2H0 for pressure testing. Continued piping installation at Generator Bldg. G-81.
- 17 Feb. Mars Site: Ran a Holiday Test on new USTs G81-1D and G81-2D. The two USTs then were lowered into place and the excavation was backfilled with pea gravel. The installation of the new USTs was witnessed by representatives of the GDSCC and JPL, and by the SBC/DEHS Inspector.
- Echo Site: A standby, fuel-storage tank was positioned next to Bldg. G-24 to prepare to empty USTs G24-1D and G24-2D so they could be cleaned.

Table 3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC (Cont'd)

- 20 Feb. Echo Site: Uncovered USTs G24-1D and G24-2D. Began the construction of the structure for GSA/FDS No. 1.
- Mars Site: Prepared forms for concrete slab to cover tops of 14-1H0 and 14-2H0 USTs.
- 21 Feb. Echo Site: In the presence of representatives of the GDSCC and E-S, and the SBC/DEHS Inspector, USTs G24-1D and G24-2D were removed from the ground. A geological team from E-S took sample soil cores to about the 40-ft depth level from the pit that had held UST G42-1G.
- MBS: Four 40-ft deep sample soil cores were taken from the pit that had held M9-4W0.
- Mars Site: Electricians began installation of new leak/level detection system conduits between Bldg. G-82 and the existing disconnect switch adjacent to USTs 14-1H0 and 14-2H0. A concrete slab was poured over these two USTs.
- 22 Feb. Echo Site: Shaped excavation pit in preparation for installation of the two new diesel tanks, G24-1D and G24-2D. A geological team from E-S took seven horizontal soil sample cores at depths of 1.5-ft and 3.0-ft at the site of UST G42-1G.
- MBS: Excavated pit to receive the new M8-1G UST for GSA/FDS No. 3.
- 23 Feb. Mars Site: Electrical conduits and junction boxes installed at Bldg. G-81.
- 24 Feb. Echo Site: New USTs G24-1W0 and G42-2D were delivered to the GDSCC.
- Mars Site: Began trenching for the southeast hydraulic oil interceptors and their piping.
- MBS: New UST M8-1G was delivered to the GDSCC.
- 27 Feb. Mars Site: New UST G14-1W0 was Holiday tested in presence of SBC/DEHS Inspector. Trenched for and installed underground electrical conduits at Bldg. G-81.
- Echo Site: Excavated and prepared pit to receive the new UST for GSA/FDS No. 1. Continued shaping of excavations to receive new USTs G24-1D, G24-2D and G24-1W0. E-S informed the Contractor to comply with Occupational Safety and Health Administration (OSHA) requirements in the excavations for USTs G24-1D, G24-2D, G24-1W0 and GSA/FDS No. 1.

Table 3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC (Cont'd)

- 28 Feb. Mars Site: UST G14-1W0 was installed and the pit was backfilled with pea gravel. Continued work on piping for fuel and vent lines for USTs G81-1D, G81-2D and G14-1W0.
- 1 Mar. Mars Site: UST G14-1W0 was prepared for a pressure test.
- 2 Mar. General: Delivery of new USTs G24-1D, G24-2D, GSA/FDS No. 1, and GDS/FDS No. 2 completed the delivery of new USTs to the GDSCC. Because of very strong wind gusts, the four USTs were not off-loaded today.
- 3 Mar. Echo Site: USTs G24-1D, G24-2D, GSA/FDS No. 1, GSA/FDS No. 2, and G24-1W0 were Holiday tested and installed into their respective excavation pits.
- 6 Mar. Echo Site: Excavation pits for the newly installed USTs G24-1D, G24-2D, G24-1W0, and GSA/FDS Nos. 1 and 2 were backfilled with pea gravel.
- Mars Site: After inspection of the interiors of the new USTs, 14-1H0 and 14-2H0, by Bert Schmitt of the GDSCC, the transfer of hydraulic oil into these two USTs was begun. To receive the southeast oil interceptors, a subgrade was prepared that used pea gravel instead of compacted backfill.
- 7 Mar. Mars Site: All piping, pumps, filters, controls and other appurtenances of the temporary hydraulic oil system were transferred, fitted and connected to the newly installed 14-1H0 and 14-2H0 USTs.
- 9 Mar. MBS: Decided to move the location of the excavation pit for UST M8-1G 5-ft to the south to avoid interference with an existing 8-in. domestic water line.
- 10 Mar. Echo Site: Pipe channel to Bldg. G-24 was opened up by jack-hammering the concrete slab of the building.
- Mars Site: Continued work on fitting piping and other systems to USTs 14-1H0, 14-2H0, G81-1D, G81-2D, and 14-1W0. Continued electrical work for hydraulic oil USTs 14-1H0 and 14-2H0.
- 13 Mar. MBS: Installed rebars for concrete island for GSA/FDS No. 3.
- 14 Mar. Echo Site: Sheet-metal canopy installed for GSA/FDS No. 1.
- Mars Site: Work continued on manways and pipe fittings for USTs G81-1D, G81-2D and 14-1H0.

Table 3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC (Cont'd)

- 15 Mar. Echo Site: Began trenching for fuel lines to run between GSA/FDS No. 1 and USTs GSA-1 and GSA-2. Work continued on manway mountings and fitting pipings for fuel lines to USTs G24-1D, G24-2D and G24-1W0.
- Mars Site: Continued backfilling around the southeast oil interceptors, and continued trenching for the piping of these oil interceptors. Continued electrical work for instrumentation of the new hydraulic and diesel USTs equipment.
- 16 Mar. Echo Site: In presence of representatives of the GDSCC, Joor Manufacturing Co., E-S, and an SBC/DEHS Inspector, USTs G42-1D and G42-2D were Holiday tested and placed into their excavation pit.
- Mars Site: Supply and return lines of USTs G81-1D and G82-2D were tested at 80 psi, in the presence of the E-S resident engineer and an SBC/DEHS Inspector. The USTs passed without any leakage.
- MBS: In presence of representatives of the GDSCC and E-S, and an SBC/DEHS Inspector, UST M8-1G was Holiday tested and placed into its excavation pit.
- 17 Mar. Echo Site: Excavation pit for USTs G42-1D and G42-2D was backfilled with pea gravel. Electrical work continued for GSA/FDS No. 1.
- MBS: Excavation pit for UST M8-1G was backfilled with pea gravel.
- Apollo Site: The GDSCC asked the Contractor to excavate a pit 12 x 22 x 4 ft (deep) at the site of removed UST A1-2G. The pit is to be backfilled and compacted to 95 percent of maximum density at optimum moisture.
- 20 Mar. General: Most workers left the GDSCC at 9:00 a.m. because of strong gusty winds. Only 16 workers remained at the site full time.
- 21 Mar. MBS: Began electrical work for GSA/FDS No. 3.
- 22 Mar. Echo Site: Forms completed for concrete island for GSA/FDS No. 1.
- 23 Mar. Echo Site: A 5 psi air-pressure test for the primary piping of the G-24 USTs diesel fuel system, and the GSA/FDS No. 1, GSA/FDS No. 2, G42-1D and G42-2D USTs was witnessed by the E-S Resident Engineer and an SBC/DEHS Inspector. The piping passed the air-pressure test.
- Mars Site: Secondary containment piping of USTs G81-1D, G81-2D and 14-1W0 passed a visual inspection test by an SBC/DEHS Inspector. This now permits the complete backfilling of the excavation pit.

Table 3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC (Cont'd)

- 24 Mar. MBS: Concrete slab poured for island of GSA/FDS No. 3.
- Mars Site: Put in anchor supports for the piping system for the hydraulic oil tanks and began to paint the supports. Began to install corrugated metal (CM) piping for the southwest oil interceptor.
- 27 Mar. Mars Site: Began to install CM piping for the southeast oil interceptor.
- 28 Mar. Echo Site: Continued glass and trim work at GSA/FDS No. 2.
- MBS: A 5 psi air-pressure test was conducted for UST M8-1G in the presence of the E-S Resident Engineer and an SBC/DEHS Inspector.
- Mars Site: Continued work at southeast and southwest oil interceptors involving forms for concrete pouring and patching for pipe transition joints, junction boxes, and headwalls.
- 29 Mar. Echo Site: Began backfilling at diesel USTs G24-1D and G24-2D, and at G24-1W0. Continued work on piping and vent lines and secondary containment piping for these USTs.
- MBS: Began to backfill excavation pit for UST M8-1G.
- 30 Mar. Mars Site: Poured concrete at transition joints, junction boxes, and headwalls of the southeast and southwest oil interceptors.
- 31 Mar. Mars Site: Prepared forms for concrete slabs for USTs G81-1D, G81-2D and 14-1W0.
- MBS: Continued piping and fitting work for GSA/FDS No. 3.
- 3 Apr. Mars Site: Continued work on piping and stripped concrete forms from the two oil interceptors. Placed rebars for concrete slabs for USTs G81-1D, G81-2D and 14-1W0.
- General: GDSCC personnel visually inspected the interiors of USTs 81-1D, G81-2D, 14-1W0, G24-1D, G24-2D and G24-1W0 before beginning to fill the diesel USTs with fuel. Interior inspections of USTs GSA/FDS No. 1, GSA/FDS No. 2, and G42-2D were performed by Gordon McCain.
- 4 Apr. Echo Site: Piping, fitting and electrical work was continued at GSA/FDS Nos. 1 and 2. Pressure testing of the fuel system piping was witnessed by the E-S Resident Engineer and an SBC/DEHS Inspector. The piping passed the pressure test.

Table 3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC (Cont'd)

- MBS: Piping, fitting and electrical work was continued at GSA/FDS No. 3. The piping passed the pressure test witnessed by the E-S Resident Engineer and a SBC/DEHS Inspector.
- Mars Site: Concrete slab poured over USTs G81-1D, G81-2D, and 14-1W0.
- 5 Apr. Echo Site: Fuel dispensers for GSA/FDS Nos. 1 and 2 were uncrated and moved to their respective concrete islands for placement. Forms prepared for concrete slabs for the G-24 diesel fuel USTs.
- MBS: Fuel dispenser for GSA/FDS No. 3 was uncrated and moved to the concrete island for placement. Piping, fitting, and electrical work was continued.
- Mars Site: Began preparation of oilspill containment concrete slab at the 14-1H0 and 14-2H0 hydraulic oil USTs. Final grading, piping and grouting was conducted at the two oil interceptors. The first load of Diesel fuel was delivered and unloaded into USTs G81-1D and G81-2D.
- 6 Apr. General: Continued work of 5 April.
- 7 Apr. Echo Site: Backfilled and compacted earth atop GSA/FDS Nos. 1 and 2 USTs. GSA/FDS No. 2 is known as the heavy equipment (HE) fueling station.
- Mars Site: The G81-1D and G81-2D diesel fuel pumps and system were tested and the fuel-level indicator was calibrated.
- 10 Apr. Echo Site: Preparation for asphalt/concrete (A/C) paving at GSA/FDS Nos. 1 and 2.
- Mars Site: Preparation for A/C paving atop G81-1D and G82-2D USTs.
- 11 Apr. Echo Site: Poured concrete for half of slab at GSA/FDS No. 1.
- MBS: Preparation for A/C paving around edges of GSA/FDS No. 3.
- Mars Site: Stripped forms from concrete slab for hydraulic oil USTs.
- 12 Apr. Echo Site: Finished pouring concrete for slabs of GSA/FDS Nos. 1 and 2. Continued electrical work for diesel G-24 USTs system.
- Mars Site: Began painting piping and pumps of hydraulic oil USTs. Finished work at the southeast and southwest oil interceptor tanks and began backfilling and compaction of earth.

Table 3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC (Cont'd)

- 13 Apr. Echo Site: Continued A/C paving at GSA/FDS No. 1.
- 14 Apr. Echo Site: Painted shade canopy of GSA/FDS No. 1.
- Mars Site: Completed grading of earth above the two oil interceptors. Drilled holes for the guard posts. Placed riprap at discharge end of the headwalls of the two oil interceptors.
- 17 Apr. Echo Site: Preparations to pour concrete slabs atop USTs G24-1D, G24-2D and G24-1W0. Began installation of auxiliary equipment at GSA/FDS Nos. 1 and 2.
- MBS: Poured concrete for two of five slabs needed at GSA/FDS No. 3.
- Mars Site: Before old USTs G81-1DA and G81-1DB are removed from the ground, the Contractor was instructed to shore up the excavation to protect existing buildings, slabs and underground piping. The two old USTs were cleaned before removal. The diesel fuel level indicators for USTs G81-1D and G81-2D were activated and the readings were incorporated into the computer software for operation-and-maintenance.
- 18 Apr. Echo Site: Concrete poured for slabs of USTs G24-1D, G24-2D, G24-1W0, G42-2D and G42-1G. The GSA/FDS Nos. 1 and 2 were calibrated. Their pumps were tested and are operational.
- Mars Site: Installed guard posts for the southeast and southwest oil interceptors.
- MBS: GSA/FDS No. 3 was calibrated. Its pumps were tested and are operational.
- 19 Apr. Echo Site: Concrete forms were stripped from the slabs of GSA/FDS No. 2. Liquid curing compound was applied to the slabs of GSA/FDS No. 2 and the G-24 and G-42 USTs. GSA/FDS Nos. 1 and 2 were inspected by the SBC/DEHS Inspector and both fueling stations met the County's air pollution requirements.
- MBS: GSA/FDS No. 3 was inspected by the SBC/DEHS Inspector and the fueling station met the County's air pollution requirements.
- Mars Site: Old UST 14-1W0 was inerted and removed from the ground. To test for possible contamination, the SBC/DEHS Inspector took samples of the soil that had been underneath the UST. It became evident that old USTs G81-1DA and G81-1DB could not be removed from the ground without damaging both underground piping and the adjacent Bldg. G-81. Consultation among JPL, GDSCC and E-S personnel led to decision to allow these USTs to be abandoned in place after first filling them with a concrete slurry. This procedure requires approval from the SBC/DEHS.

Table 3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC (Cont'd)

- 20 Apr. Echo Site: Began electrical work for lighting at GSA/FDS Nos. 1 and 2. Paved demolished area around UST G25-1G and areas around GSA/FDS Nos. 1 and 2 with A/C.
- Mars Site: Backfilled and compacted the earth that filled the pit from which the old UST 14-1W0 had been removed. Removed old piping around the inverted old USTs G81-1DA and G81-1DB. Backfilled and compacted the earth that had been added to the excavation. Painted the piping and exposed metal structures at the new G-81 diesel USTs and at the hydraulic oil USTs.
- 21 Apr. Echo Site: Installation of concrete curbing at GSA/FDS No. 1.
- Mars Site: A/C paving at G-81 and hydraulic oil USTs.
- MBS: A/C paving of roadway leading to GSA/FDS No. 3. Old UST M27-1G was cleaned in preparation for its excavation.
- 24 Apr. Echo Site: A trench was excavated next to old UST G27-1G and soil samples were taken for the SBC/DEHS Inspector.
- MBS: Old UST M27-1G was removed from the ground in the presence of GDSCC and E-S personnel and a SBC/DEHS Inspector. Soil samples from the bottom of the excavation were taken by both GDSCC personnel and a SBC/DEHS Inspector.
- 25 Apr. Echo Site: Dismantled and removed old GSA/FDS No. 1.
- MBS: Completed demolition of old GSA/FDS No. 3 and backfilled and compacted the excavation from which old UST M27-1G had been removed. Scrap metal from the demolition was hauled away. Completed painting of the piping at new GSA/FDS No. 3.
- 26 Apr. General: Compaction tests of all backfilled pits at UST sites passed the specifications.
- 27 Apr. General: Gasoline leaks were detected at all three GSA/FDSs. Source of leaks is a loose joint below the valve containment boxes under the fuel dispensers. E-S informed the Contractor that the GDSCC was not satisfied with the operation of the three fuel dispensing stations with respect to their low rate of output, the noise they generate, and occasional vibrations. The Contractor promised to rectify these abnormalities.
- 28 Apr. Echo Site: A/C paving was performed adjacent to Bldg. G-24, atop of GSA/FDS Nos. 1 and 2 USTs, and adjacent to GSA/FDS No. 2.
- Apollo Site: Placed A/C paving over demolished areas from which old USTs A1-1G and A1-2G had been removed.

Table 3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC (Cont'd)

- 1 May General: Gasoline leaks were repaired at all three fuel dispensing stations. Part of concrete slab at GSA/FDS No. 1 at Echo Site had to be demolished to effect repair of leak. The demolished portion of the concrete slab is to be replaced. The SBC/DEHS Inspector visited the GDSCC and inspected all the new fuel and hydraulic oil USTs. Their leak detection systems were tested and all USTs were found to be in acceptable working condition. The Contractor began to demobilize his equipment.
- 2 May Echo Site: Warning signs were posted at GSA/FDS Nos. 1 and 2. Secured manway covers and spill containers at all USTs.
- 3 May Echo Site: Completed repair of concrete slab at GSA/FDS No. 1. Applied slurry seal to all A/C pavement patches.
- MBS: Completed A/C paving next to GSA/FDS No. 3.
- Mars Site: Completed painting of guard posts surrounding the southeast and southwest oil interceptors. Slurry seal applied to A/C paved areas.
- 4 May General: Rates of fuel delivery at GSA/FDS No. 1 (4.5 gpm using two hoses and 6.6 gpm using one hose) were unacceptable. There also was extensive noise and vibration. The Contractor will consult with the manufacturer of the fuel dispenser and will resolve these discrepancies.
- 5 May General: Auxiliary equipment (towel dispensers, trash can, log cabinet, water bucket and squeegees) was installed at the three fuel dispensing stations.
- Mars Site: Cleaned up the electrical raceway trench adjacent to the hydraulic oil tanks.
- 8 May General: Continued demobilization of Contractor's equipment.
- 9 May Mars Site: Repaired leak in diesel fuel system of G81 USTs. Installation of a nipple with a cap for the sump at the containment area for the hydraulic oil USTs 14-HO. A control panel, horn and emergency light was installed in Bldg. G-82 for the level indicator of the hydraulic oil USTs.
- 10 May General: Identification letters (G - gasoline, D - Diesel, WO - waste oil, HO - hydraulic oil) were welded onto the covers of the inlets of the diverse USTs.

Table 3. Chronology of Work Involved in Removal and Replacement of Underground Storage Tanks at the GDSCC (Cont'd)

11 May MBS: Malfunctioning fuel dispensing nozzle was replaced at GSA/FDS No. 3.

Echo Site: A representative of the manufacturer of the fuel dispensers visited the GDSCC to resolve the rate of flow, noise, and vibration problems at GSA/FDS No. 1.

General: This 11 May 1990 entry is the final Daily Field Report submitted by the E-S Resident Engineer.

██████████

██████████ INTENTIONALLY BLANK

SECTION V

INSTALLATION OF 13 NEW UNDERGROUND STORAGE TANKS AT THE GDSCC

Following the removal of 23 USTs and the abandonment of three USTs in place, as described in Section IV, the GDSCC conducted work to replace their storage functions with the installation of 13 new USTs as follows: Echo Site (7 USTs), Mars Site (5 USTs), and Mojave Base Site (one UST). Each of the 13 new USTs complies with county, state, and Federal regulations that pertain to construction and monitoring requirements for the underground storage of hazardous materials.

The progress of the work involving UST replacement, which was completed in mid-May 1989, is summarized in a chronology of work dealing with the removal and replacement of USTs at the GDSCC (see Table 3 at end of Section IV).

A. CONSTRUCTION OF THE 13 NEW USTs FOR THE GDSCC

The 27 old USTs that had been removed from or abandoned at the GDSCC had been constructed of single-walled steel shells with no outer coating for corrosion protection, and no instrumentation to monitor and detect leaks.

The 13 new USTs at the GDSCC are constructed of double-walled steel shells with outer fiberglass coating for corrosion protection, and a monitoring system in the annular space between the inner and outer shells to detect any failure in either shell. Double containment and leak-detection monitoring of new USTs are legislative requirements demanded by the State of California Health and Safety Code, Division 20, Chapter 6.7 dealing with Underground Storage of Hazardous Substances.

Table 4 is a summary of the 13 new USTs now installed at the GDSCC: their designated names, capacities in gallons, nature of the contents they hold, their U.L. Serial Numbers, and the nature of their pumps.

Of the 13 new USTs, 11 were placed into new excavations that specifically were dug for each new UST. The two remaining new USTs, G81-1D and G81-2D at the Mars Site, were placed into an enlarged and shaped excavation from which two old USTs had been exhumed.

The 13 new USTs at the GDSCC are known by their trademark names as Plasteel Composit and are of a design that is manufactured by Joor Manufacturing Co., Escondido, California. In this case, however, the 13 new USTs were fabricated by K&T Steel Corp., Twin Falls, Idaho, under license from Joor Manufacturing Co. The warranties for the 13 new USTs are provided by K&T Steel Corp. and the collected warranties are presented in Appendix C.

Figure 28 is a cross-sectional drawing of a typical double-walled UST now installed at the GDSCC and fitted with a monitoring system to detect leaks.

Table 4. Summary of the Status of 13 New Underground Storage Tanks
Now at the GDSCC

Tank Number	Capacity (gal)	Contents	U.L. Serial Numbers	Tank Pump Type
<u>Echo Site</u>				
G24-1D	25,000	Diesel	L-158054	Suction
G24-2D	25,000	Diesel	L-158055	Suction
G27-1G (GSA-1)	10,000	Unleaded	L-158059	Suction
G27-2G (GSA-1)	10,000	Unleaded	L-158060	Suction
G24-1W0	3,000	Waste Oil	L-158057	N/A
G42-1G (GSA-2)	2,000	Unleaded	L-158043	Suction
G42-2D	3,000	Diesel	L-158058	Suction
<u>Mars Site</u>				
G81-1D	25,000	Diesel	L-158052	Submersible
G81-2D	25,000	Diesel	L-158053	Submersible
14-1H0	10,000	Hydraulic Oil	L-158046	Suction
14-2H0	10,000	Hydraulic Oil	L-158047	Suction
14-1W0	2,000	Waste Oil	L-158042	N/A
<u>Mojave Base Site</u>				
M8-1G (GSA-3)	4,000	Unleaded	L-158051	Suction

N/A Not applicable.

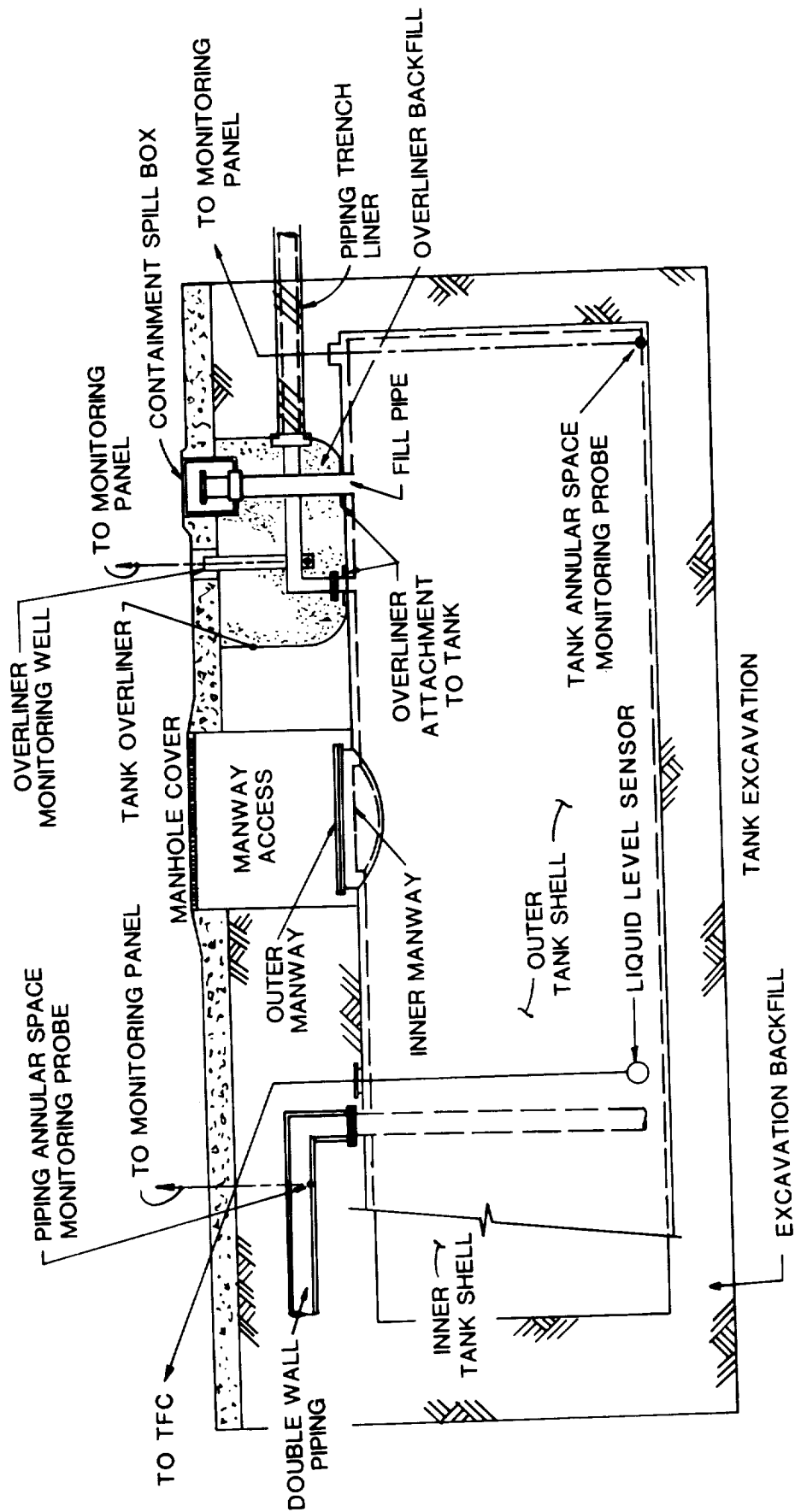


Figure 28. Cross Section of a Typical Double-Walled Underground Storage Tank Now Installed at the GDSCC and Fitted with a Leak-Detection Monitoring System

B. INSTRUMENTATION FOR THE 13 NEW USTs AT THE GDSCC

Two types of instrumentation are installed in each new UST: leak monitoring and liquid-level monitoring. The instruments involved and their components have UL and/or Factory Mutual approval for their specific application. Leak monitoring devices and their instrumentation meet all applicable San Bernardino County regulatory requirements.

1. Leak-Monitoring Instrumentation

Leak-monitoring equipment consists of four principal components: (a) a detector in the double-walled tank annulus, (b) a detector in the piping well/manway or tank overliner, (c) a monitoring panel and, (d) appropriate wiring for the system.

Annular space leak-detector probes are able to detect the presence of both water and the tank contents in both their liquid and vapor states. Piping from the tanks is of (a) double-walled, fiberglass construction with the annular space draining into a piping well/manway atop the tank or, (b) single-walled, carbon-steel construction inside of a trench liner connected to an overliner above the tank. A second detector probe capable of detecting both water and the liquid and vapor states of the tank contents is placed in the manway or overliner.

A leak-detection monitoring panel provides visual and audible alarms in the event a leak and/or troublesome condition is detected. The visual display indicates the detector from which the alarm has come. Monitoring panels are weatherproof and can be exterior-mounted. If a monitoring panel intrinsically cannot be mounted on the exterior, a weatherproof housing is provided when outside installation is required. A monitoring panel also has relays that can signal a remote station in Bldg. G38 of the Echo Site in the event of a troublesome or leak-alarm condition (see below).

The monitoring system wiring, including power supply connections, remote station hookups, and component connections, comply with all manufacturers specifications, regulatory requirements, and applicable codes.

2. Instrumentation to Monitor Liquid Levels in USTs

Instrumentation to monitor the liquid levels of the 13 new USTs is placed inside each tank. The instrumentation provides a 4 to 20 mA electrical signal that can be read at the remote monitoring station located in Bldg. 38 of the Echo Site.

3. Remote Station to Monitor the 13 New USTs

The GDSCC is a large complex in which many different operations are performed continuously, or occasionally, or simultaneously. To monitor a variety of systems and alarms associated with these diverse operations, the GDSCC has installed a computer-controlled system, known as the Technical Facilities Controller (TFC), housed at the Echo Site in Bldg. 38, the main maintenance facility at the GDSCC.

In the case of the USTs, each leak-monitoring panel at a tank can relay an electrical signal to the TFC in the event of any leak or other tank malfunction. The signal indicates which UST is involved, which probe within the tank has sounded the alarm, and whether the problem is a leak or other malfunction.

Because many of the new USTs are located at great distances from Bldg. 38 at the Echo Site, any signal from each UST first is transmitted to a unit called Sensor for Control of Arterials and Networks (SCANN). Each SCANN unit is located in a building near the location of the individual USTs. Any signals received by each SCANN unit then are transmitted to the TFC at the Echo Site.

The panels that monitor leaks at each UST are connected to the local SCANN unit with standard wire pairs. The instruments that monitor liquid levels within each UST, however, will send their 4 to 20 mA signals to the local SCANN unit with shielded cable pairs.

On the diagrams that follow in Section V.G, the locations of specific new USTs and the location of the SCANN units that serve these USTs are shown.

C. GENERAL PROCEDURES FOR THE INSPECTION AND INSTALLATION OF 13 NEW USTs AT THE GDSCC

All of the 13 new USTs at the GDSCC are of double-walled, steel construction covered with an outer coat of fiberglass. Since the fiberglass coat could have pinholes that could nullify the corrosion protection of the UST, each tank was tested for pinholes before being placed into the ground.

The pinhole test is known as the Holiday spark test and is conducted by passing a 3-ft wide wand over the surface of the tank. The wand is electrified at a potential of 35,000 volts and if a pinhole is encountered a visible spark is seen to leap from the wand to the steel tank. At the same time, the Holiday instrument emits an audible beep to indicate a flaw in the fiberglass coat. Any pinholes encountered can be repaired on the spot so that the tank is interred with a flawless fiberglass coat. A typical Holiday-test procedure is depicted in Figure 29.

In addition to the Holiday test pertaining to a UST's outer fiberglass coat, the tanks themselves were air-tested to see if there were any leaks in the tank's fitting and seams. Each tank was sealed and compressed air was admitted to a pressure no greater than 5 psi. Soapy water around the tank's fitting and seams then revealed whether there were any flaws that would result in leaks.

The preparation of the new excavations to receive the new USTs, the handling and placement of the tanks, and the operations to backfill the excavations once the USTs were in place underground, were all performed in accordance with specifications recommended by the pertinent manufacturers. Before an excavation was backfilled, the integrity of each UST's piping was tested by an air-pressurization procedure.

After an excavation was backfilled, but before the area was resurfaced with concrete, the integrity of each tank and its piping was tested again in the presence of an SBC/DEHS Inspector.

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



Figure 29. Typical Holiday Test Procedure to Detect Pinholes in Outer Fiberglass Coat Before UST is Interred

Thus, all installation and testing procedures of the 13 new USTs at the GDSCC conformed to applicable county and state environmental regulations.

D. PIPING SPECIFICATIONS FOR THE 13 NEW USTs AT THE GDSCC

The piping required for the 13 new USTs at the GDSCC varies according to the nature of the liquid held by the UST.

(1) Piping for Unleaded Gasoline USTs

The General Services Administration (GSA) of the Federal government owns the vehicles and fuel-dispensing stations at the GDSCC, which then are leased to JPL/NASA. The gasoline consumed by GDSCC vehicles is bought by JPL/NASA from the GSA. Thus, the three dispensing stations (FDSs) at the GDSCC are known as GSA/FDSs. Two GSA/FDSs (Nos. 1 and 2) are at the Echo Site, while GSA/FDS No. 3 is at the Mojave Base Site.

The new piping for the three new USTs that store the gasoline for the three GSA/FDSs is of double-walled fiberglass construction. The annulus of the piping opens into a manway on top of the tank from which it originates. This manway acts as a collection and monitoring point for liquids and vapors that enter the piping's annular space. The piping is sloped such that free liquids entering the piping annulus will drain to the manway.

(2) Piping for Diesel Oil and Waste Oil USTs

All new piping for USTs that store waste oil or diesel fuel for generators is of wrapped steel construction installed within a trench liner. The trench liner opens into an overliner above the tank from which the piping originates. The overliner acts as a collection and monitoring point for liquids and vapors that enter the trench liner. The latter is sloped so that free liquids released from the piping drain to the overliner. Trench liners and tank overlayers are constructed of materials that are resistant to chemical damage that could be caused by the specific materials stored in the tanks. Dielectric unions are used to connect all carbon-steel pipe to an UST.

E. PUMP SPECIFICATIONS FOR NEW USTs AT THE GDSCC

Nine of the 13 new USTs at the GDSCC are equipped with suction pumps to deliver their stored liquids to pertinent equipment. The three GSA/FDSs, two at the Echo Site and one at the Mojave Base Site, are equipped with UL-approved suction pump fuel dispensers. Each dispenser can deliver 20 gal/min of gasoline through each dispensing hose.

Two of the 13 new USTs at the GDSCC are waste-oil tanks and are not equipped with pumps.

The remaining two new USTs, G81-1D and G81-2D at the Mars Site, are each of 25,000 gal capacity and deliver diesel fuel to Bldg. G81, the Mars Site Generator Building. They are equipped with UL-approved submersible turbine pumps, with each pump capable of delivering 20 gal of diesel fuel per minute to Bldg. G81.

The two submersible turbine pumps are equipped with pipeline leak detectors capable of restricting the output of the pumps in the event a leak is detected. In addition, an override system capable of bypassing or negating the flow restriction device also has been installed. This allows GDSCC personnel to maintain antenna operations during critical tracking periods even in the event of a piping leak.

The two, 25,000 gal-capacity, diesel fuel, new USTs at the Echo Site, G24-1D and G24-2D, that deliver diesel oil to Bldg. G24, the Echo Site Generator Building, are not equipped with submersible turbine pumps. The suction pumps that already existed in Bldg. G24 are used to draw the diesel fuel from these two new USTs.

F. SPECIFICATIONS FOR OVERFILL PROTECTION AND VAPOR RECOVERY FOR NEW USTs AT THE GDSCC

Each new UST at the GDSCC is equipped with containment fill boxes to prevent contamination caused by either an overfilled tank or the leaking of product-delivery hoses. The containment fill boxes have a 5-gal capacity and are fitted with a drain assembly to return the captured product to the UST. Each containment fill box has a traffic-rated cover and a watertight cover seal and was installed in accordance with SBC/DEHS environmental requirements.

In addition, each of the four USTs that contain unleaded gasoline, G27-1G, G27-2G and G42-2G at the Echo Site and M8-1G at the Mojave Base Site, is equipped with a balance-type vapor recovery system (VRS). These VRS include coaxial drop tubes, vapor recovery dispenser nozzles and hoses, and vapor recovery piping. The VRSs were installed in accordance with SBC/DEHS requirements.

G. SPECIFIC INSTALLATION OF 13 NEW USTs AT THE GDSCC

The installation of the 13 new USTs at the GDSCC is described, by site, as follows:

(1) Echo Site:

Of the 13 new USTs installed at the GDSCC, seven are at the Echo Site and consist of three unleaded gasoline USTs, three diesel oil USTs, and one waste oil UST.

A detailed plot plan of the Echo Site, as of 1990, is depicted in Figure 30. A generalized plot plan showing the location of the seven new USTs, the building, G24, that houses the SCANN unit, and the locations of eight old USTs that had been removed, is illustrated in Figure 31.

a. New UST Group 24

This group consists of three new USTs: two, new 25,000 gal, diesel fuel, USTs, G24-1D and G24-2D, and a 2,000 gal waste oil tank designated G24-1W0. The two diesel tanks and the waste oil tank actually are located northwest of Bldg. G24, the Echo Site Generator Building, and not southwest as

FOLDOUT FRAME

2.

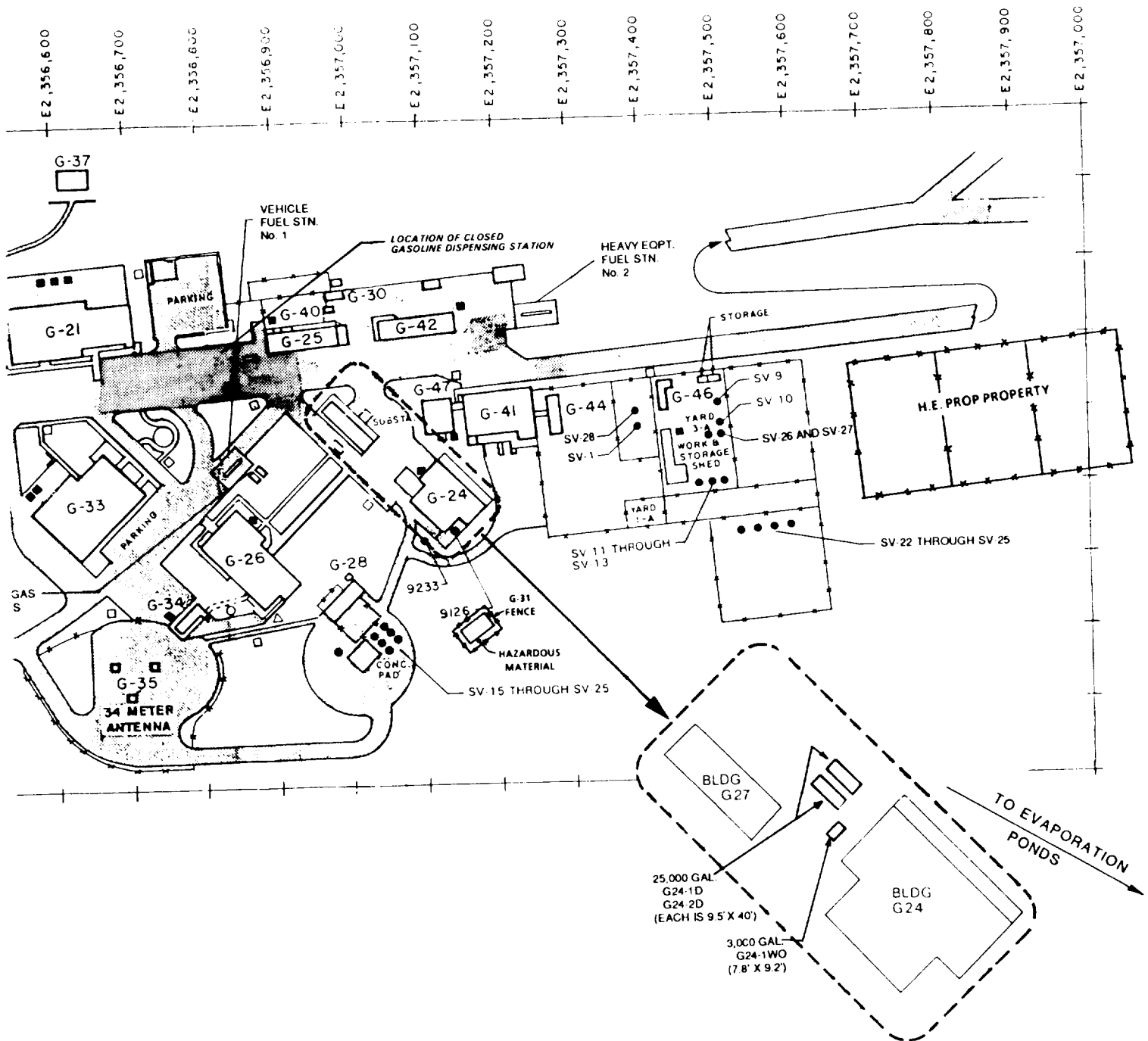
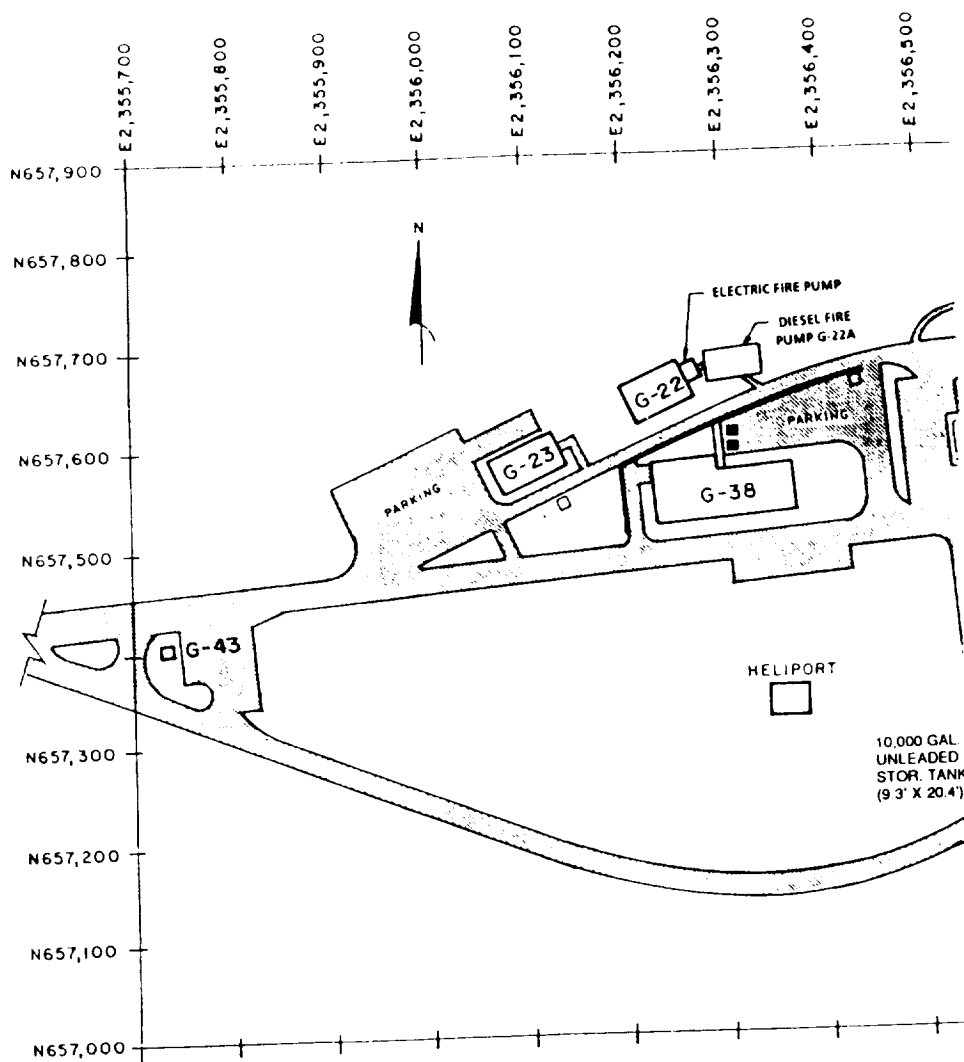


Figure 30. Echo Site: Detailed Plot Plan as of 1990

FOLDOUT FRAME



LEGEND

- TRAILER OR VAN LOCATION
- ASPHALT PAVEMENT
- x ACCESS CONTROL FENCE
- FIRE HYDRANT AND HOSE HOUSE
- △ TV TOWER
- LIGHT TOWER (SURVEILLANCE TV)
- DUMPSTER LOCATION
- FUEL TANK □ DIESEL
- JETIC TANK □ GASOLINE

INVENTION

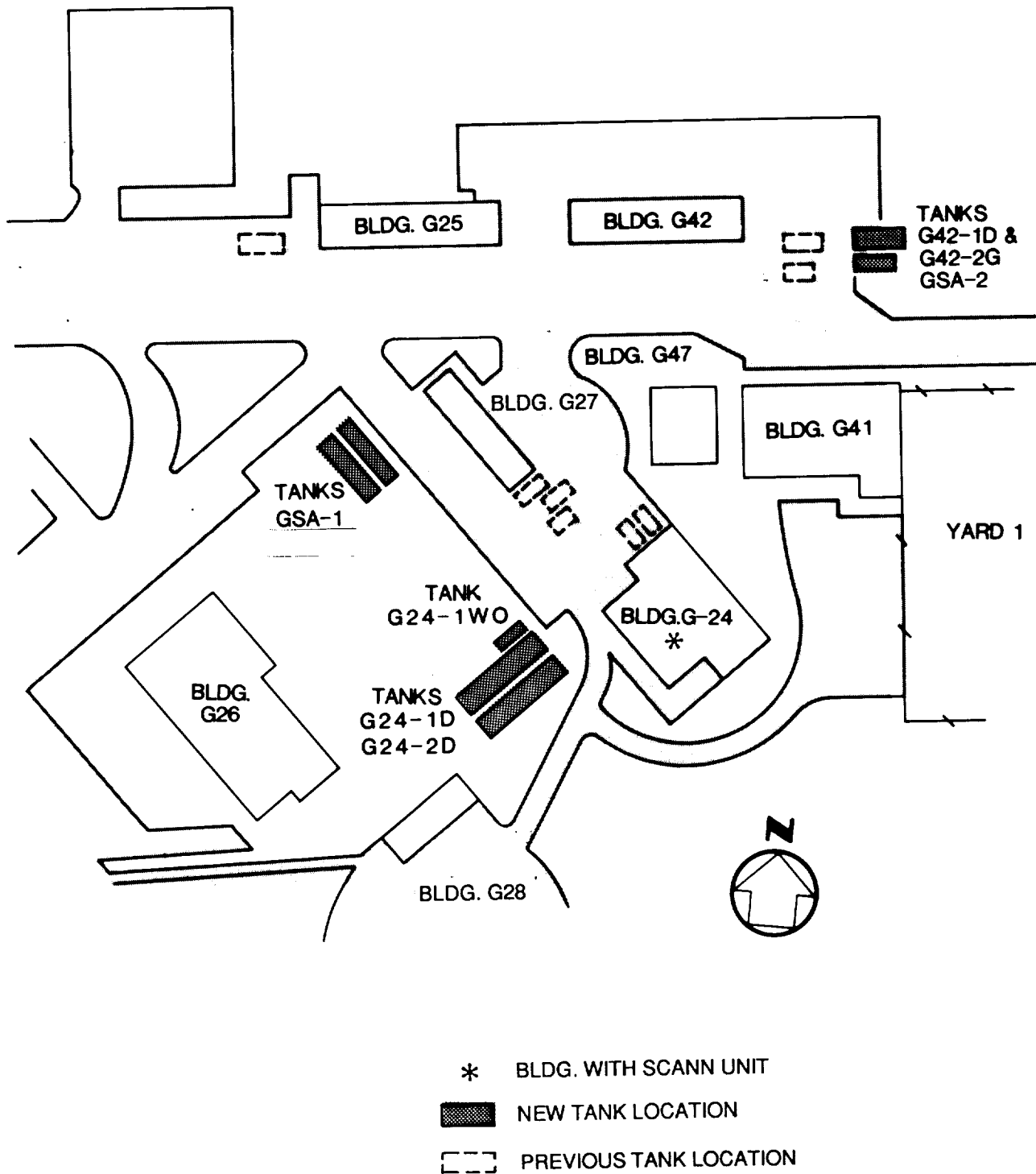


Figure 31. Echo Site: Generalized Partial Plot Plan Showing Locations of Seven New USTs, SCANN Unit Building, and Locations of Eight Old USTs that had been Removed

erroneously indicated in Figure 31. New piping runs from the two diesel tanks to the piping for the suction pumps that already are emplaced in Bldg. G24. The leak-detection monitoring panel for the three G24 tanks is located inside Bldg. G24.

The installation of one of the two G24 diesel tanks is illustrated in Figure 32.

UST G24-1W0 is a new, 2,000 gal tank to store waste oil from the lubrication of the diesel generating units located in Bldg. G24. The tank is connected to the previously existing piping that drained the generating units. The surface around the UST's fillpipe is concrete surrounded by a raised berm to catch and contain any waste oil that is spilled while the tank is either filled or drained.

b. New UST Group 27

This group consists of two, new, 10,000 gal, unleaded gasoline tanks, G27-1G and G27-2G. In Figure 31, these two USTs are identified as GSA-1 because they supply unleaded gasoline to GSA/FDS No. 1 located southwest of Building G27.

A diagram of the new GSA/FDS No. 1 showing the pump island, two-hose suction pump fuel dispenser, lighted overhead canopy, air and water reels, weatherproof logbook housing, leak-detection monitoring panel, trash container, windshield washing fluid container, paper towel dispenser, and fire extinguisher is depicted in Figure 33.

The specific GSA/FDS No. 1 is surfaced in concrete and is graded so that rainwater flows to the southeast. Its lighted canopy, with a minimum vertical clearance of 14 ft, provides protection against the elements during fueling of vehicles. The canopy is anchored in compliance with requirements for structures located in a Seismic Zone 4 area and is sufficiently strong to withstand the periodically powerful wind gusts experienced at the GDSCC.

All electrical and water lines between GSA/FDS No. 1 and nearby buildings are located underground and comply with all applicable regulatory guidelines and codes. Any signals from the monitoring panel run to the SCANN unit in Bldg. G24, for transmission to the TFC in Bldg. 38, as depicted in Figure 34.

Installation of the two, 10,000 gal, unleaded gasoline USTs, G27-1G and G27-2G, at the Echo Site is illustrated in Figure 35. The completed new fuel dispensing station, GSA/FDS No. 1, is shown in Figure 36.

c. New UST Group 42

This group of two, new USTs consists of a 3,000 gal diesel fuel tank, G42-1D, and a 2,000 gal unleaded gasoline tank, G42-1G. The two tanks will deliver their respective fuels to GSA/FDS No. 2, a new fuel dispensing station located southeast of Bldg. G42, the Heavy Equipment Shop (see Figures 31 and 37).

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH

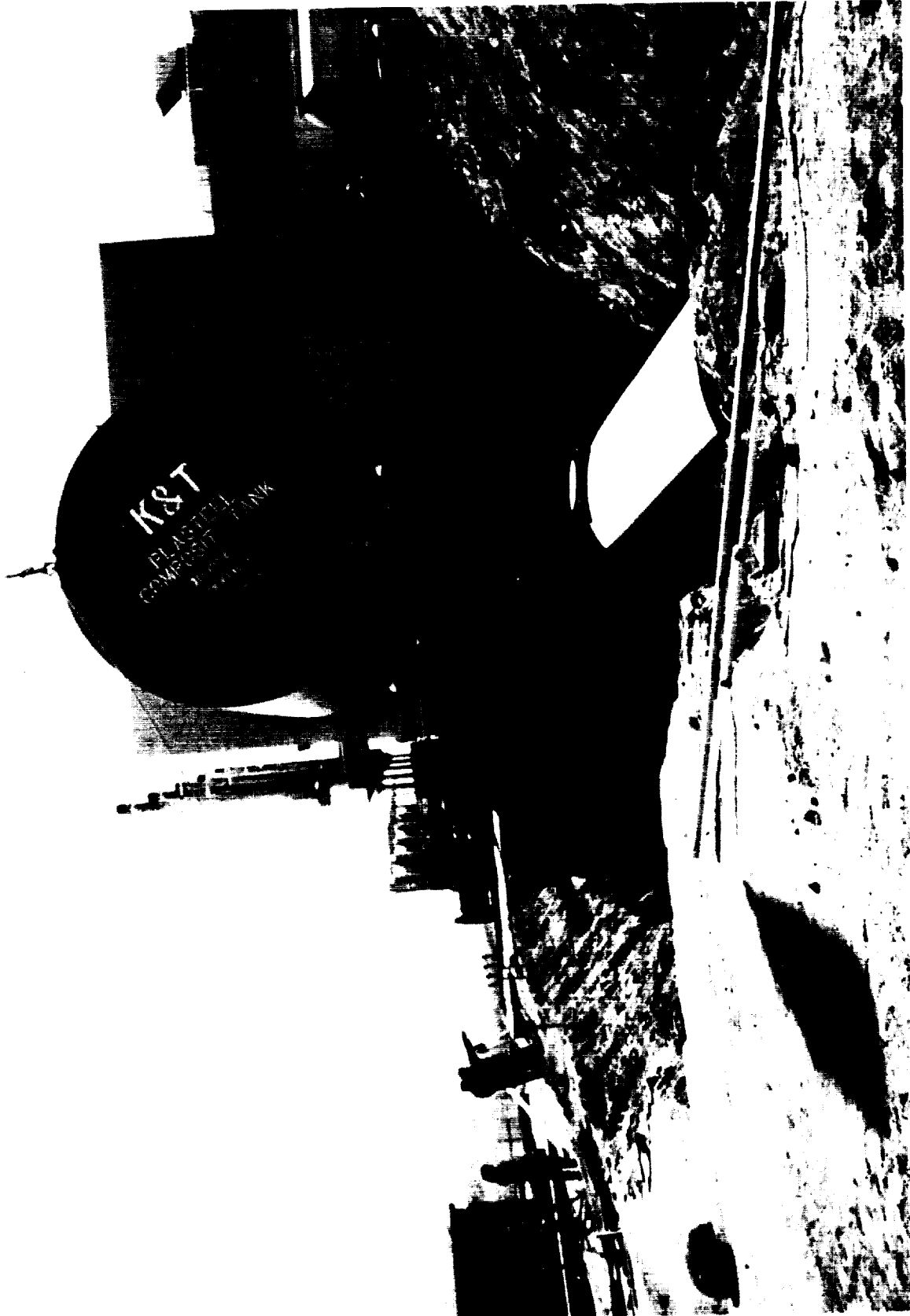


Figure 32. Echo Site: Installation of a G24, 25,000 Gallon Diesel Tank
Northwest of Bldg. G24

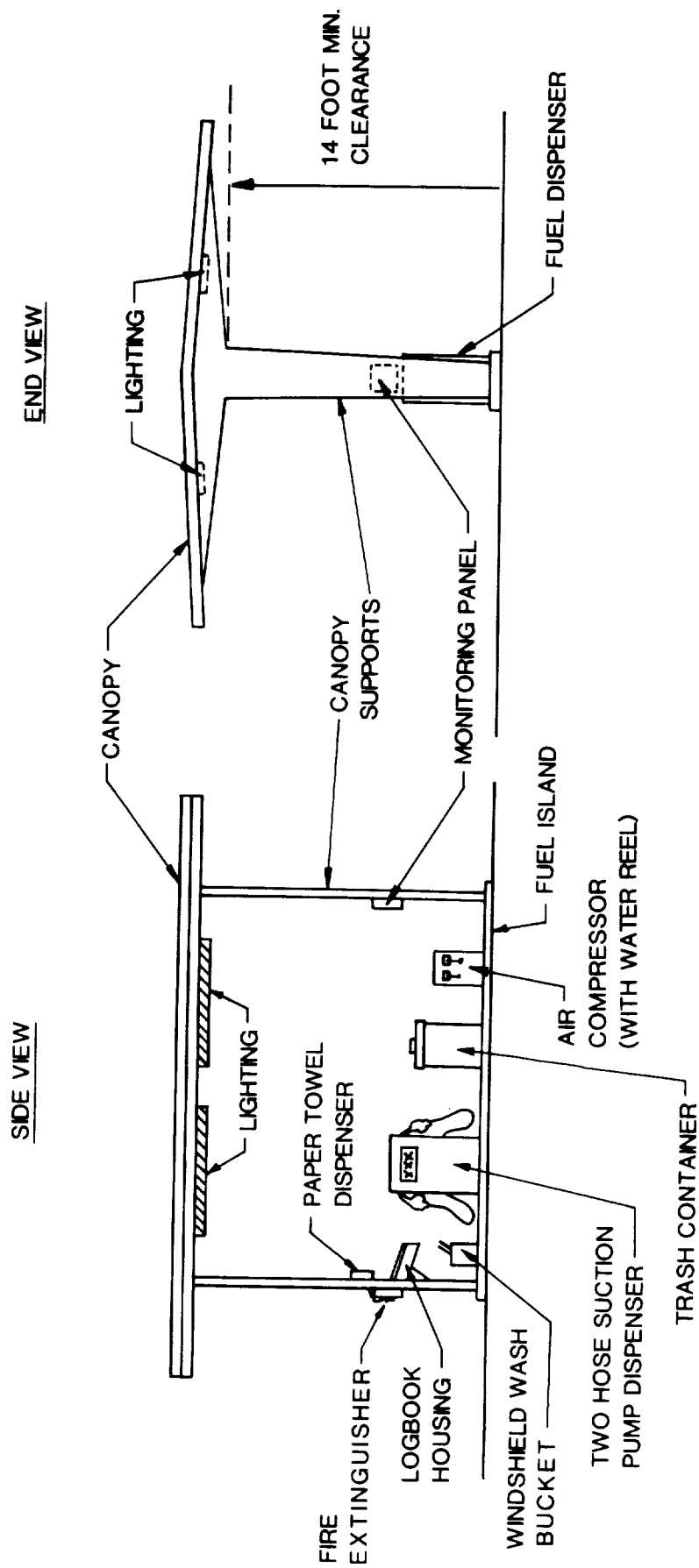


Figure 33. Diagram of New GSA/FDS No. 1 at the GDSCC with its Canopy and Accessory Equipment

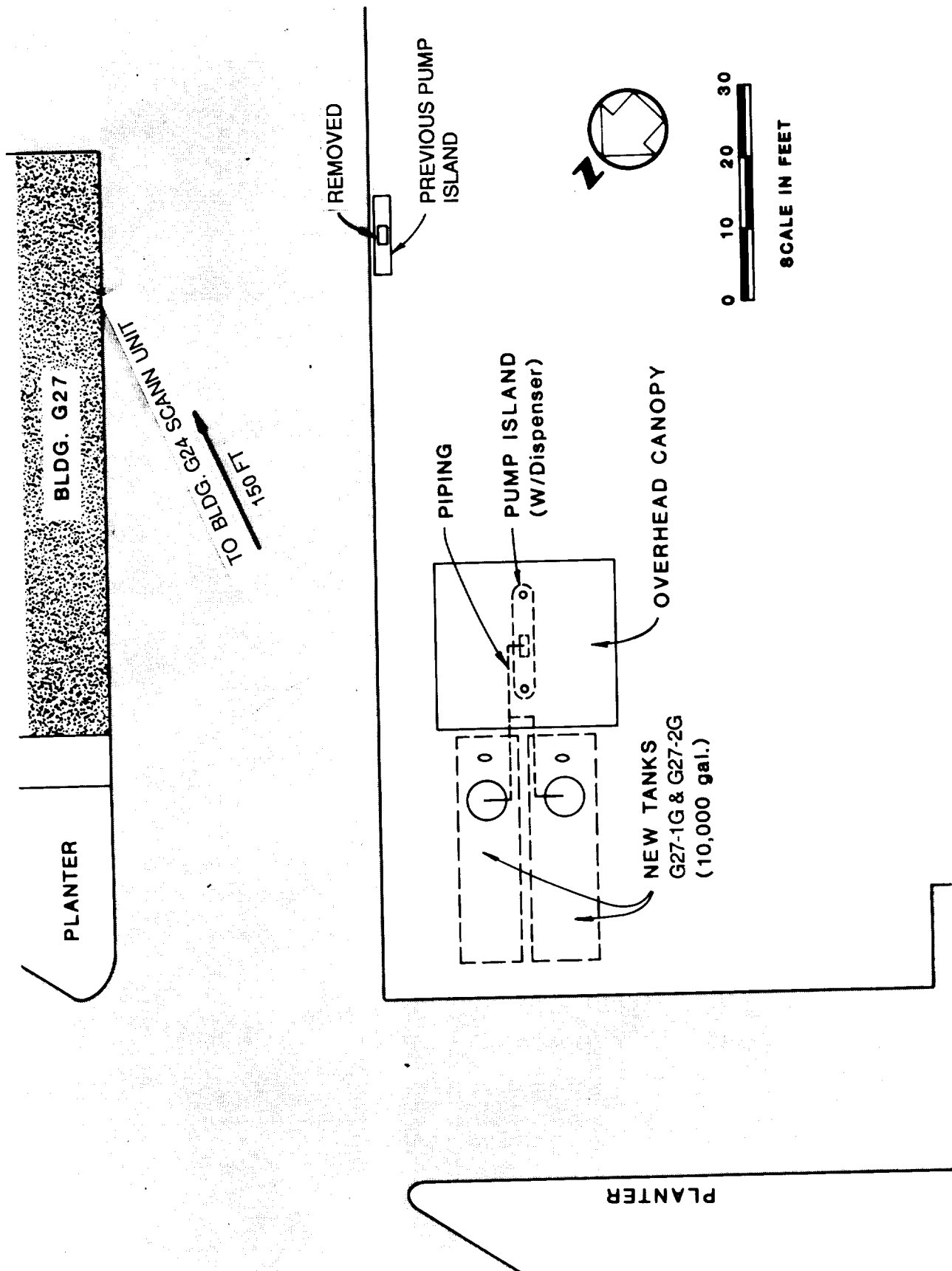


Figure 34. Echo Site: Diagram Showing Location of New GSA/FDS No. 1

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



Figure 35. Echo Site: Installation of Two, New, 10,000 Gallon, Unleaded Gasoline Tanks at GSA/FDS No. 1

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



Figure 36. Echo Site: Completed New Fuel Dispensing Station, GSA/FDS No. 1

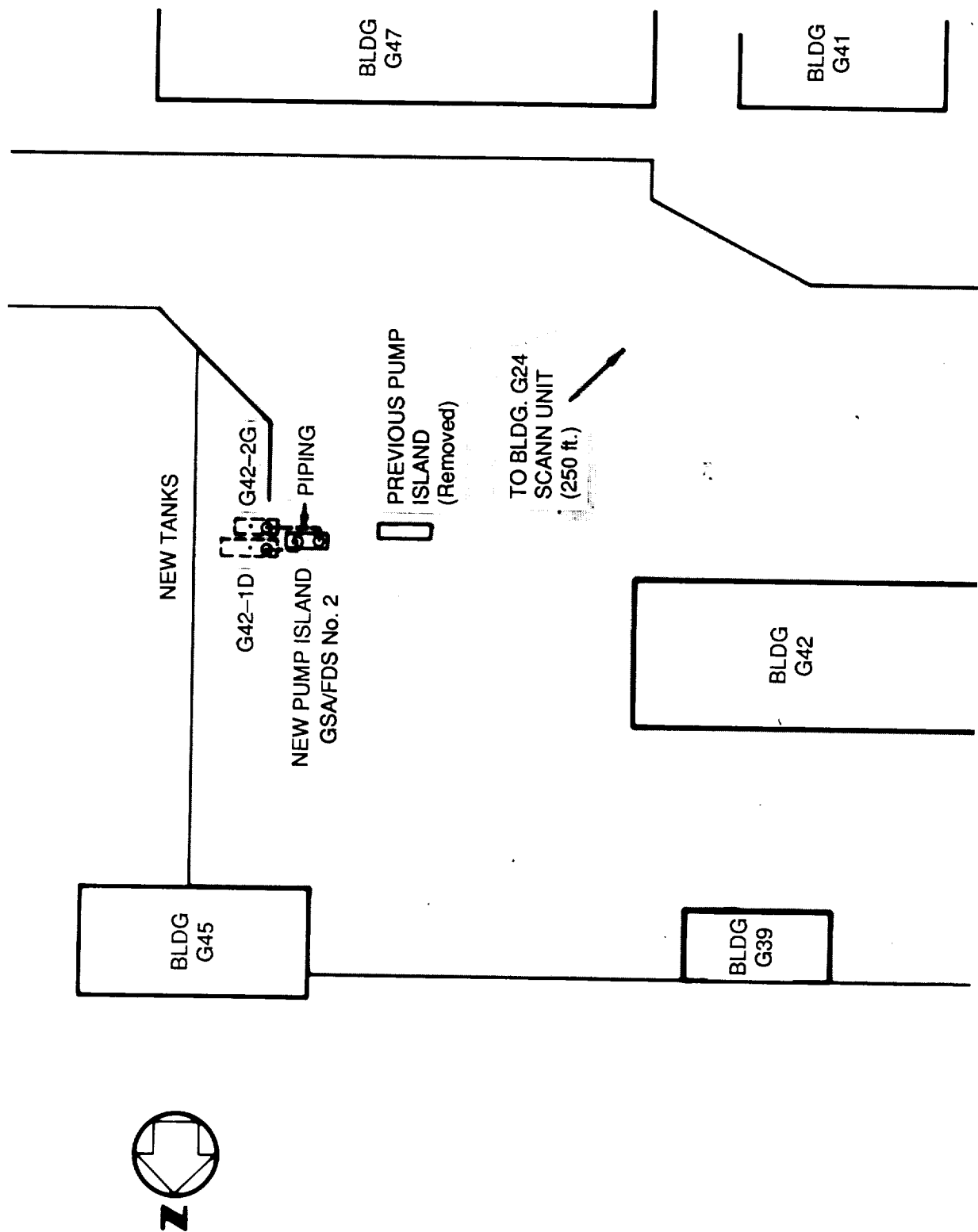


Figure 37. Echo Site: Diagram Showing Location of New GSA/FDS No. 2

Handwritten signature or initials

The GSA/FDS No. 2 pump island includes two, new, single-hose, suction pump fuel dispensers. Electrical power, compressed air, and water lines are underground and comply with all applicable regulatory guidelines and codes.

The GSA/FDS No. 2 is surfaced in concrete and is graded so that rainwater runs to the south of the facility. Footings for the station's lighting fixture will be sufficient to withstand the high winds experienced periodically at the GDSCC.

(2) Mars Site:

Of the 13 new USTs installed at the GDSCC, five are at the Mars Site and consist of two diesel oil tanks, two hydraulic oil tanks, and one waste oil tank.

A detailed plot plan of the Mars Site, as of 1990, is depicted in Figure 38. A generalized partial plot plan showing the locations of the five new USTs, the buildings, G81 and G82, that house the SCANN units and the locations of five old USTs that had been removed, is illustrated in Figure 39.

a. New UST Group G81

This group consists of two, new, 25,000 gal, double-walled steel tanks, designated G81-1D and G82-2D, located southwest of Bldg. G81, the Mars Site Generator Building. The two USTs hold diesel oil to supply the diesel generators in Bldg. G81. Instead of being placed into a new excavation pit, these two new USTs were interred in a pit that was expanded and shaped following the removal of two old USTs, G81-2D and G81-3D.

New, double-walled piping runs from the tanks to the piping already existing within Bldg. G81. Typical views of the double-walled piping used are illustrated in Figures 40 and 41. Connection of the double-walled piping to the USTs is shown in Figure 42.

Submersible turbine pumps can deliver the diesel oil to the generators at a rate of 20 gallons/minute.

The leak-detection monitoring panel for the two new USTs is placed inside Bldg. G81, as is the SCANN unit.

After the two new USTs were placed in the ground, and their piping connections were completed, the excavation pit was backfilled with pea gravel (see Figure 43) and the area was resurfaced with concrete to complete the installation of the new USTs (see Figure 44).

b. New UST Group 14

This is a group of three new USTs: two are designated 14-1HO and 14-2HO and are 10,000 gal tanks to hold hydraulic oil for the Mars Antenna, while the third is a 2,000 gal tank designated 14-1WO that holds waste oil from the diesel generating units in Bldg. G81.



5-20

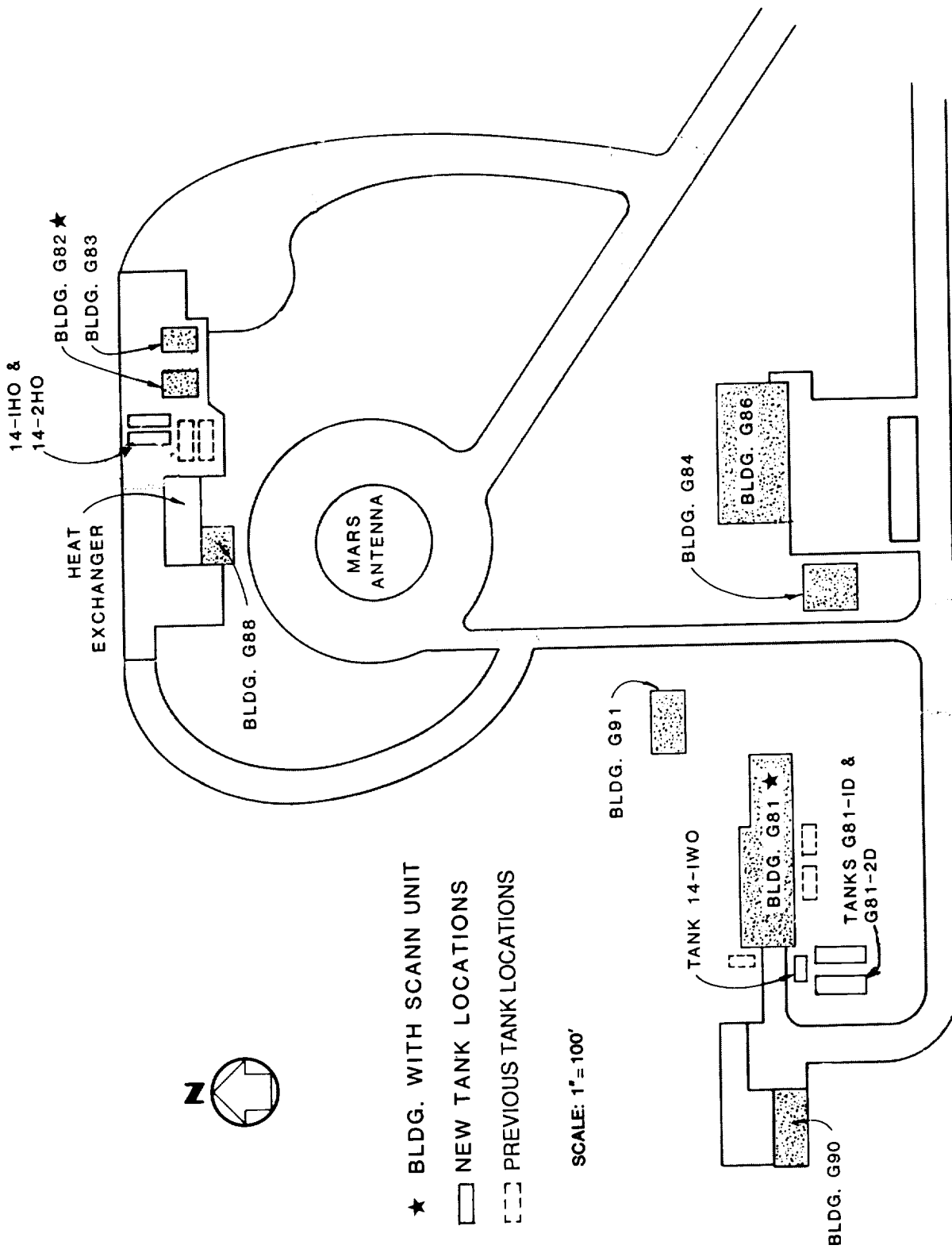


Figure 39. Mars Site: Generalized Partial Plot Plan Showing Locations of Five New USTs, SCANN Unit Buildings, and Locations of Five Old USTs that had been Removed

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH

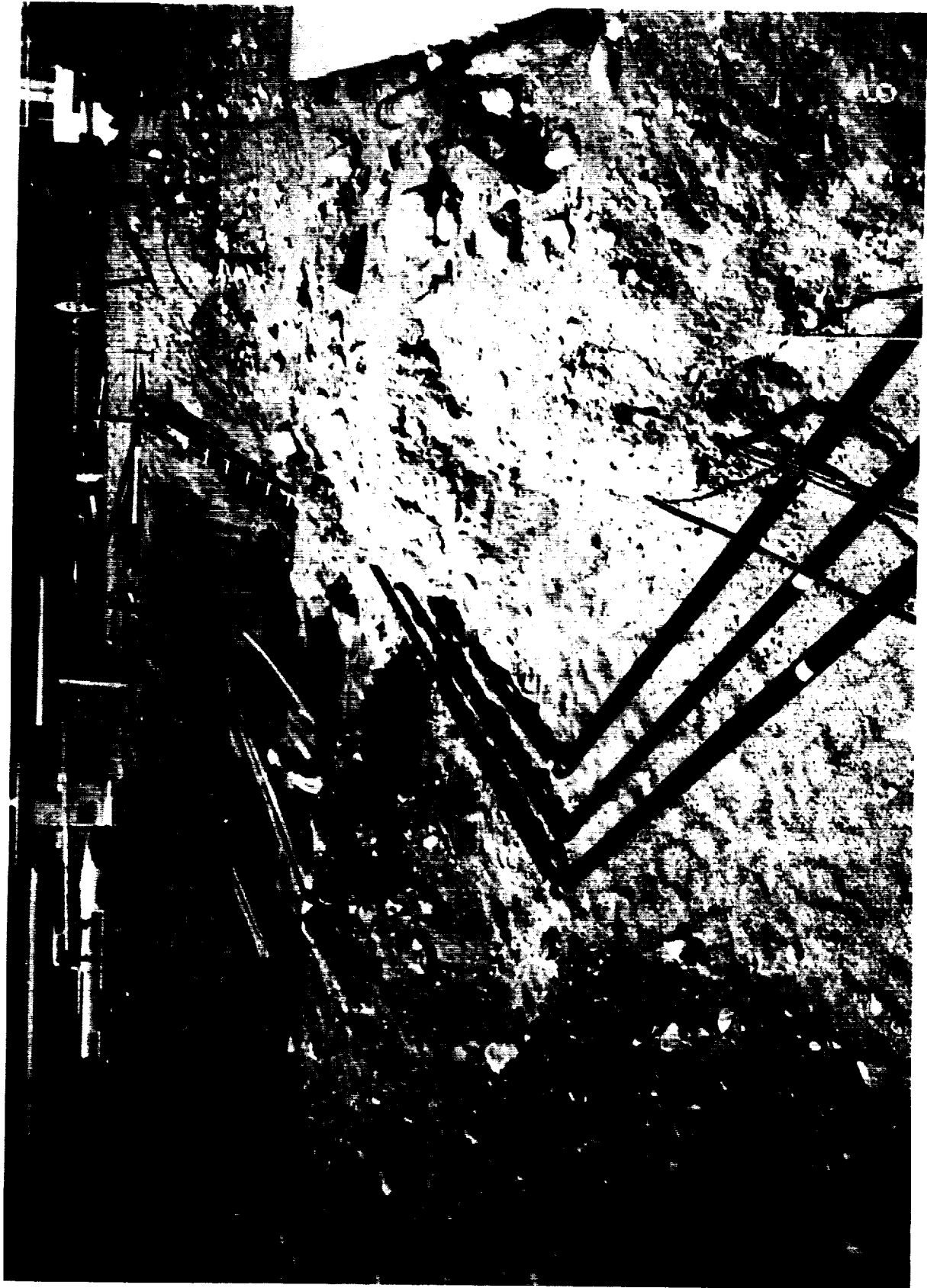


Figure 40. Mars Site: Typical View of New Double-Walled Piping Leading
From New USTs G81-1D and G81-2D to G81, Generator Building

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



Figure 41. Mars Site: New Double-Walled Piping Leading from USTs G81-1D and G81-2D to Bldg. G81

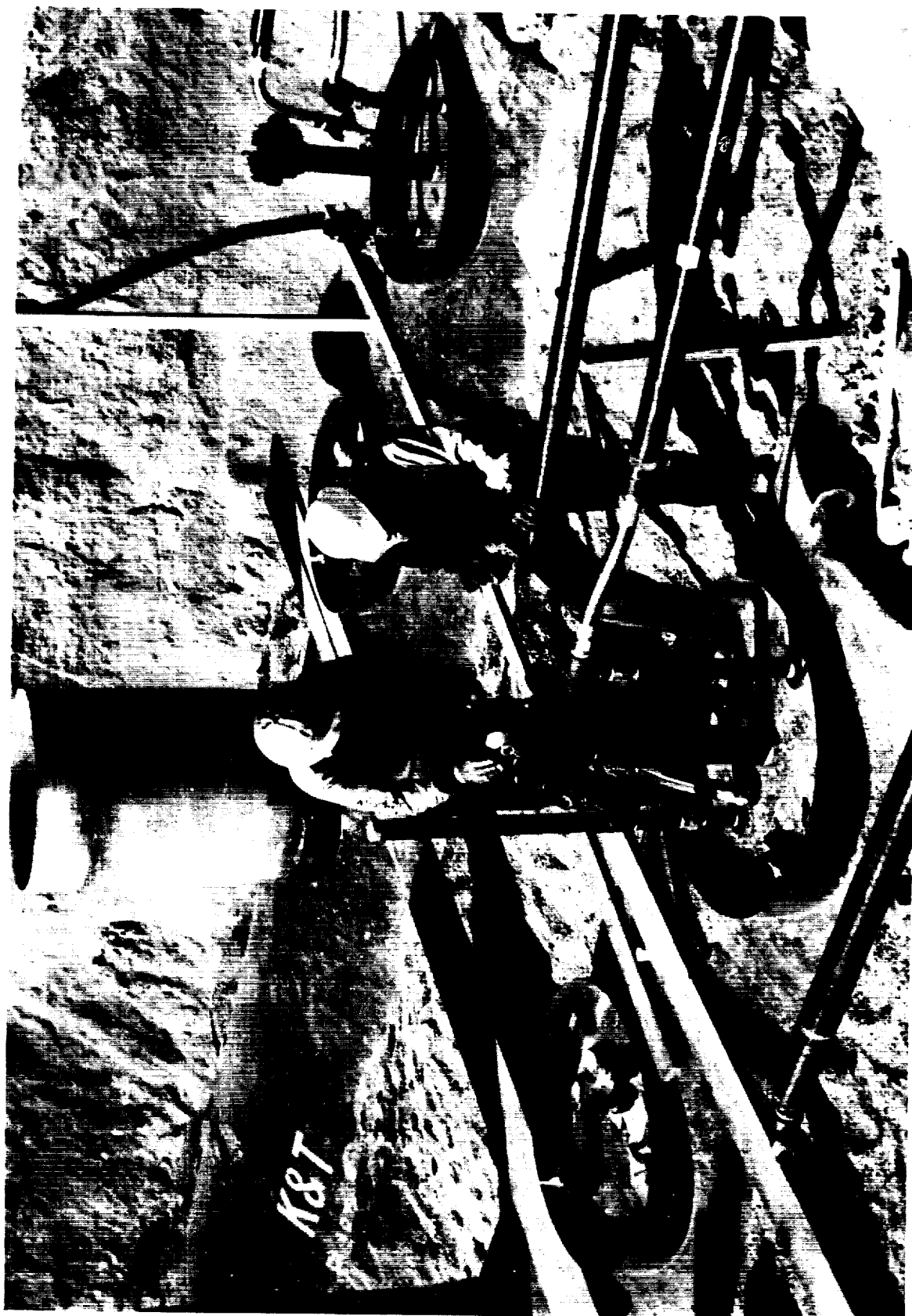


Figure 42. Mars Site: Connection of New Double-Walled Piping to New USTs
G81-1D and G81-2D near Bldg. G81

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH

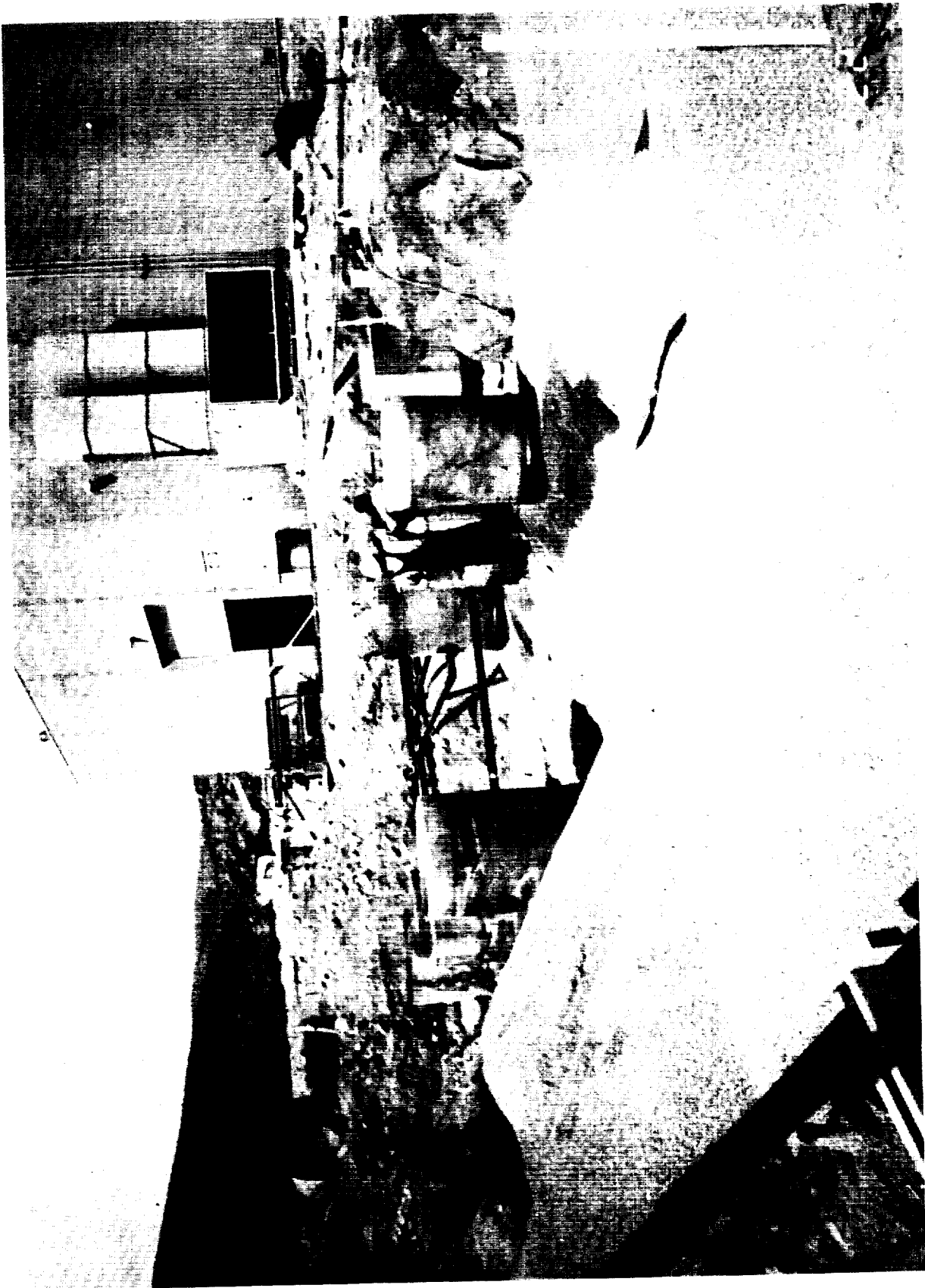


Figure 43. Mars Site: Backfilling with Pea Gravel of the Excavation Pit
in which USTs G81-1D and G81-2D are Interred

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH



Figure 44. Mars Site: Completed Installation of Interred USTs C81-1D and C81-2D with Concrete Surfaces

The two new hydraulic oil tanks and their piping, located west of Bldg. G82, the Pump House Building, were installed before the two old hydraulic oil tanks were removed to reduce the amount of downtime for the Mars Antenna's hydraulic system. The leak-detection monitoring panel for USTs 14-1H0 and 14-2H0 is located in Bldg. G82.

UST 14-1W0 is located southwest of Bldg. G81, the Mars Site Generator Building (see Figure 39). It is connected to the piping system that drains the diesel generators in Bldg. G81. The surface around the UST's fillpipe is concrete surrounded by a raised berm to catch and contain any waste oil spilled in either filling or draining the tank. The leak-detection monitoring panel for this UST is located inside Bldg. G81.

(3) Mojave Base Site:

Of the 13 new USTs installed at the GDSCC, only one new UST, designated M8-1G, is at the Mojave Base Site. It is a 4,000 gal, unleaded gasoline UST located southwest of Bldg. M8, the Operations Building, in the extreme eastern part of the site (see Figures 20 and 45).

The old UST, which M8-1G replaced, was designated M27-1G, and before its removal was located at the very western edge of the site (see Figure 20).

The new UST, M8-1G, serves as the unleaded gasoline storage tank for the new GSA/FDS No. 3. A more detailed diagram of the location of the GSA/FDS No. 3 is depicted in Figure 46.

The lighted pump island at GSA/FDS No. 3 includes a new, single-hose, suction pump fuel dispenser, an electrically powered air compressor, and a concrete surface graded to the west for the runoff of rainwater. Electrical power and water lines run underground to the island from nearby buildings and they comply with all applicable regulatory guidelines and codes.

The monitoring panel alarm relay and liquid-level instrumentation send their electrical signals to a new SCANN unit in Bldg. M8 for transmission to the TFC in Bldg. 38 at the Echo Site.

Footings for the island's lighting are sufficiently strong to allow the light fixture to withstand the high winds periodically experienced at the GDSCC.

H. GENERAL: CERTIFICATION AND CALIBRATION OF THE 13 NEW USTs AT THE GDSCC

The installation of each new Plasteel Composit Underground Storage Tank required inspections at five phases during the installation: general, visual inspection, handling, excavation depth and bedding and backfill, and testing. When each installed tank had passed inspections for these five phases, a Certificate of Installation was presented and signed by Mr. Robert J. Zochowski of Joor Manufacturing, Inc., Escondido, California.

The various Certificates of Installation are presented in Appendix D.

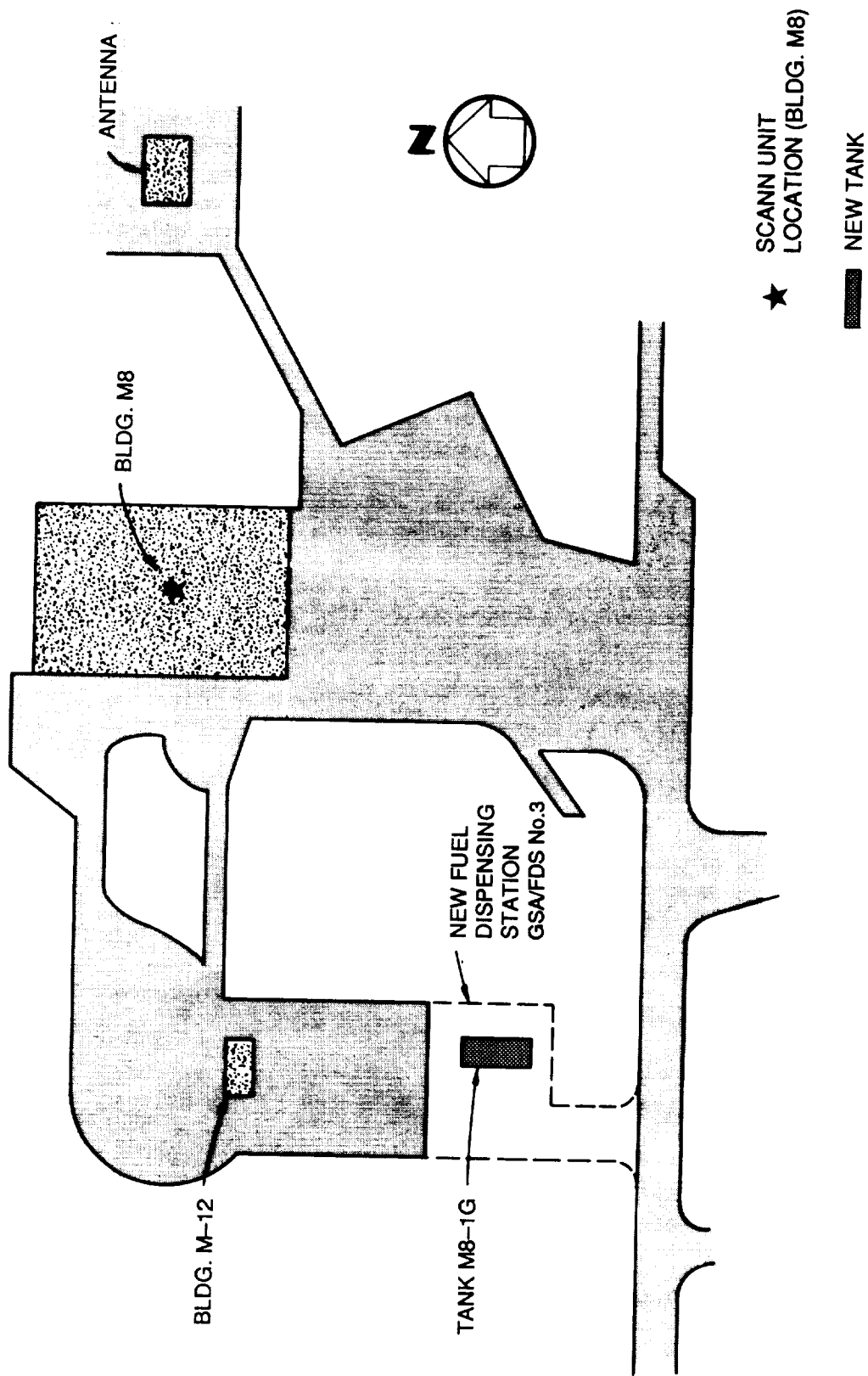


Figure 45. Mojave Base Site: Generalized Partial Plot Plan Showing Location of New UST M8-1G and Bldg. M8 with SCANN Unit, in Eastern Part of Site

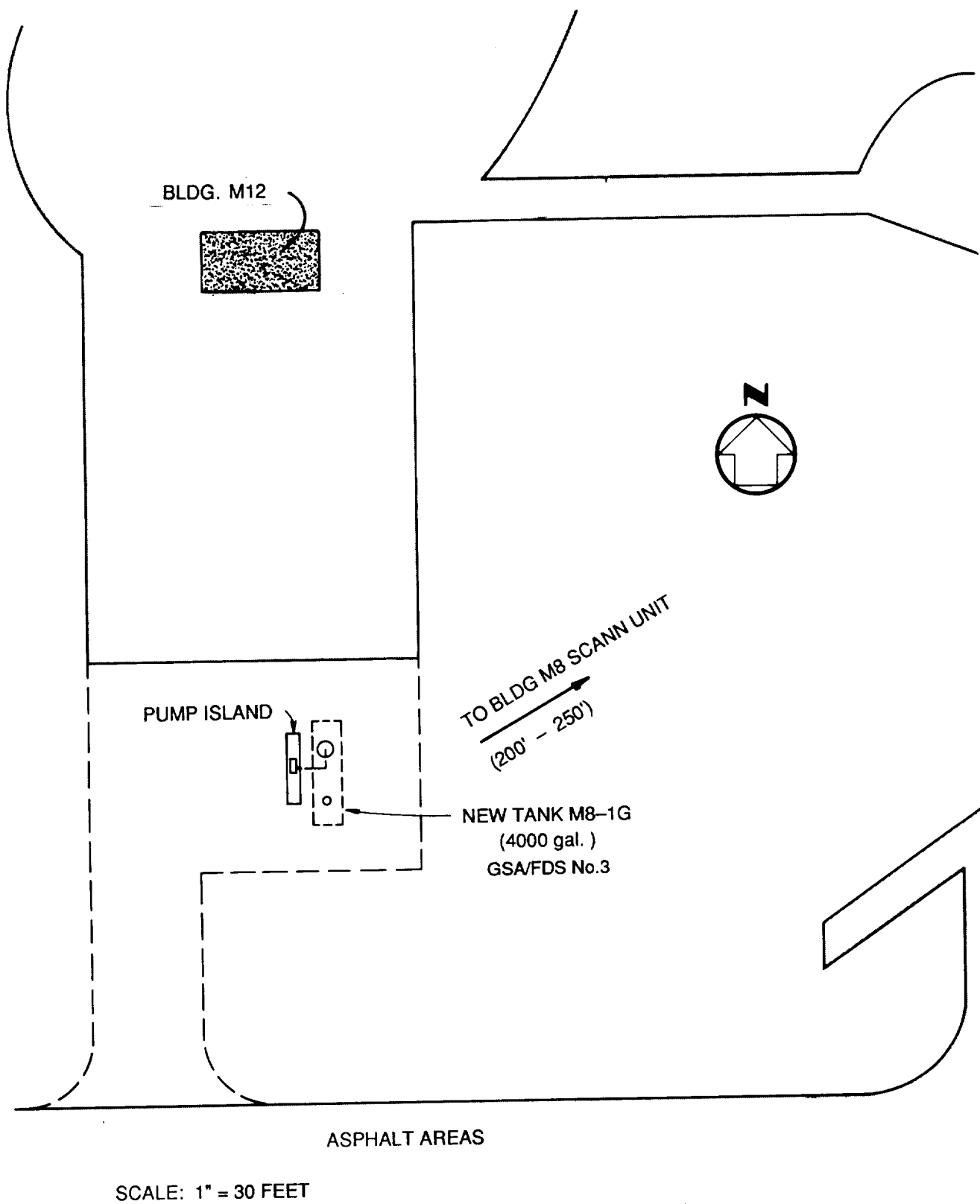


Figure 46. Mojave Base Site: Location of New GSA/FDS No. 3 with New UST M8-1G

After the new USTs were installed, each tank was calibrated to indicate the relationship between the depth of liquid in the tank and the amount of liquid in the tank in gallons. The calibrations were carried out by Joor Manufacturing, Inc., Escondido, California, and the Calibration Charts are presented in Appendix E.

SECTION VI

EXPANSION OF THE HYDRAULIC OIL INTERCEPTOR SYSTEM AT THE MARS SITE

The 70-m antenna at the Mars Site (DSS 14) requires hydraulic oil for its operation. The installation of USTs 14-1H0 and 14-2H0, two new USTs each of 10,000 gal capacity to supply the hydraulic oil to the antenna, is described in Section V.G(2).

A. RAINWATER RUNOFF COLLECTION AND HYDRAULIC OIL INTERCEPTION AT THE MARS SITE

In 1988, rainwater runoff from the Mars Antenna was collected by a concentric grating-covered trench surrounding the base of the antenna and then was channeled into two eight-in. diameter subsurface diversion pipes. In the event of a failure in the antenna's hydraulic system, the released hydraulic oil could enter the rainwater collection system. To prevent this oil from being discharged into the environment, an oil interceptor system had been installed near the end of each subsurface pipe. The interceptor system consists of one 1,250-gal, concrete oil/water separator placed before each diversion pipe's outfall into intermittent stream channels approximately 400 feet from the antenna. A diagram of this rainwater collection system is depicted in Figure 47. The oil/water separators are identified as 14-2WT and 14-3WT.

In the event of a catastrophic failure of the antenna's hydraulic system, up to 11,000 gallons of hydraulic oil could have entered the rainwater collection system. The maximum capacity of the interceptor system in 1988, however, was 2,500 gallons of hydraulic oil depending on where the oil entered the collection system. Thus, hydraulic oil spills greater than 2,500 gal would be released into the environment through one or both of the intermittent stream channels.

Such release of hydraulic oil into the environment could not be tolerated because California State regulations require that prudent precautions be taken to prevent environmental impairment caused by the unintentional release of hazardous substances into the environment. Thus, expansion of the hydraulic oil interceptor system at GDSCC's Mars Site was required as a prudent precaution to prevent potential release of hydraulic oil from the antenna into intermittent stream channels adjacent to the area. One previous accidental release of hydraulic oil from the Mars antenna had been of sufficient volume to fill the existing oil interceptor system beyond its capacity. Thus, ample expansion of the existing interceptor system was necessary to prevent any future releases of hydraulic oil into the environment.

B. NEW HYDRAULIC OIL INTERCEPTOR SYSTEM INSTALLED AT THE MARS SITE

In 1989, a new hydraulic oil interceptor system was created by keeping the old system and expanding it by the addition of a bank of three new concrete interceptor tanks to each of the two old interceptor units.

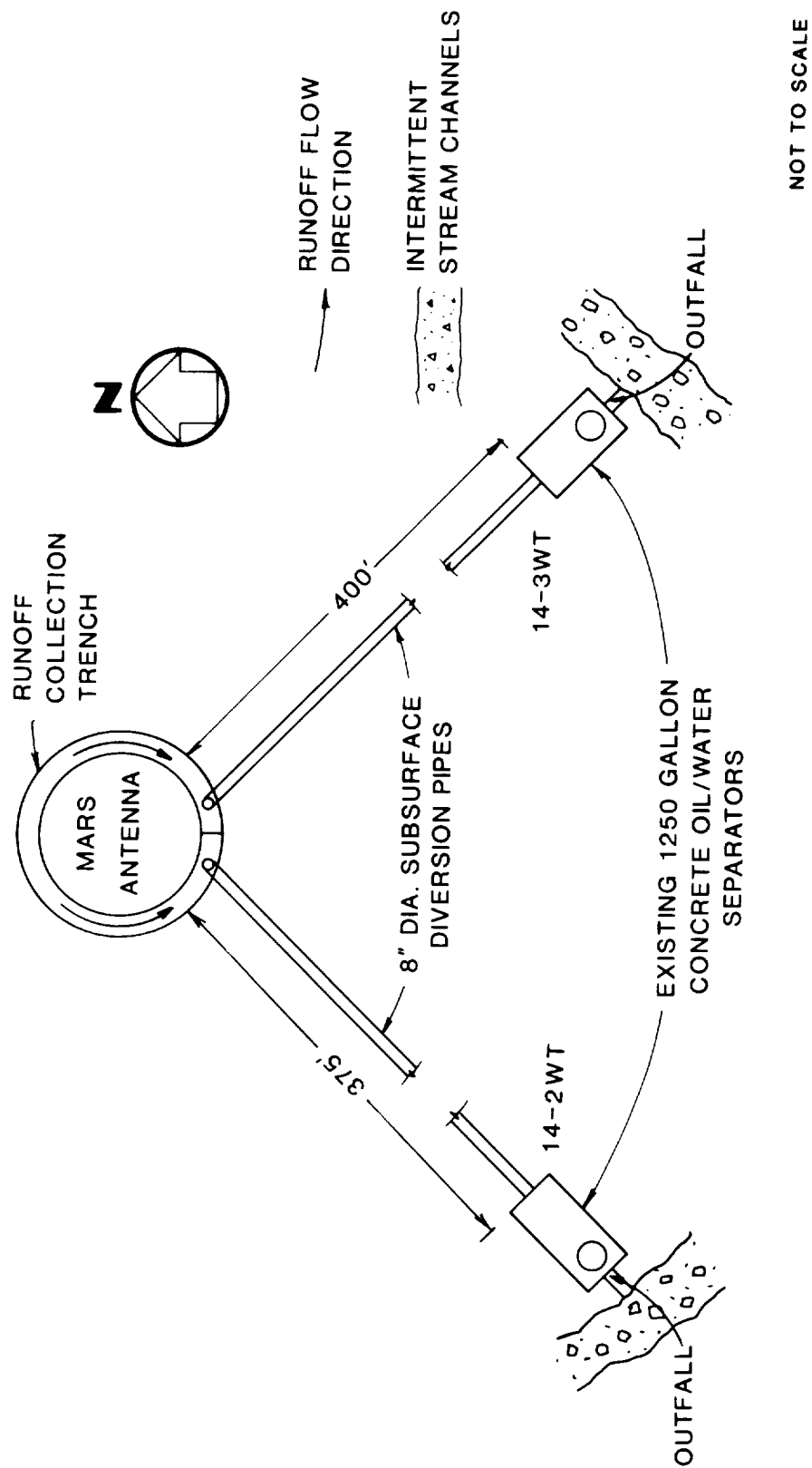


Figure 47. Mars Site: Rainwater Collection System and Concrete Oil/Water Separators of the Hydraulic Oil Interceptor System as they were in 1988

The three, new, added tanks to each of the two interceptor lines consist of a new 1,250 gal concrete tank connected to two new parallel, 5,000 gal concrete tanks, connected to an old 1,250 gal tank (see Figure 48). Thus, each of the two tanks of oil interceptors now has a capacity to catch 12,500 gal, enough to accommodate the maximum volume of hydraulic oil that could be released during a catastrophic failure of the hydraulic system of the Mars Antenna.

A cross section of each of the four, new, 5,000 gal, precast concrete oil/water separator units in the new hydraulic oil interceptor system at the Mars Site is depicted in Figure 49.

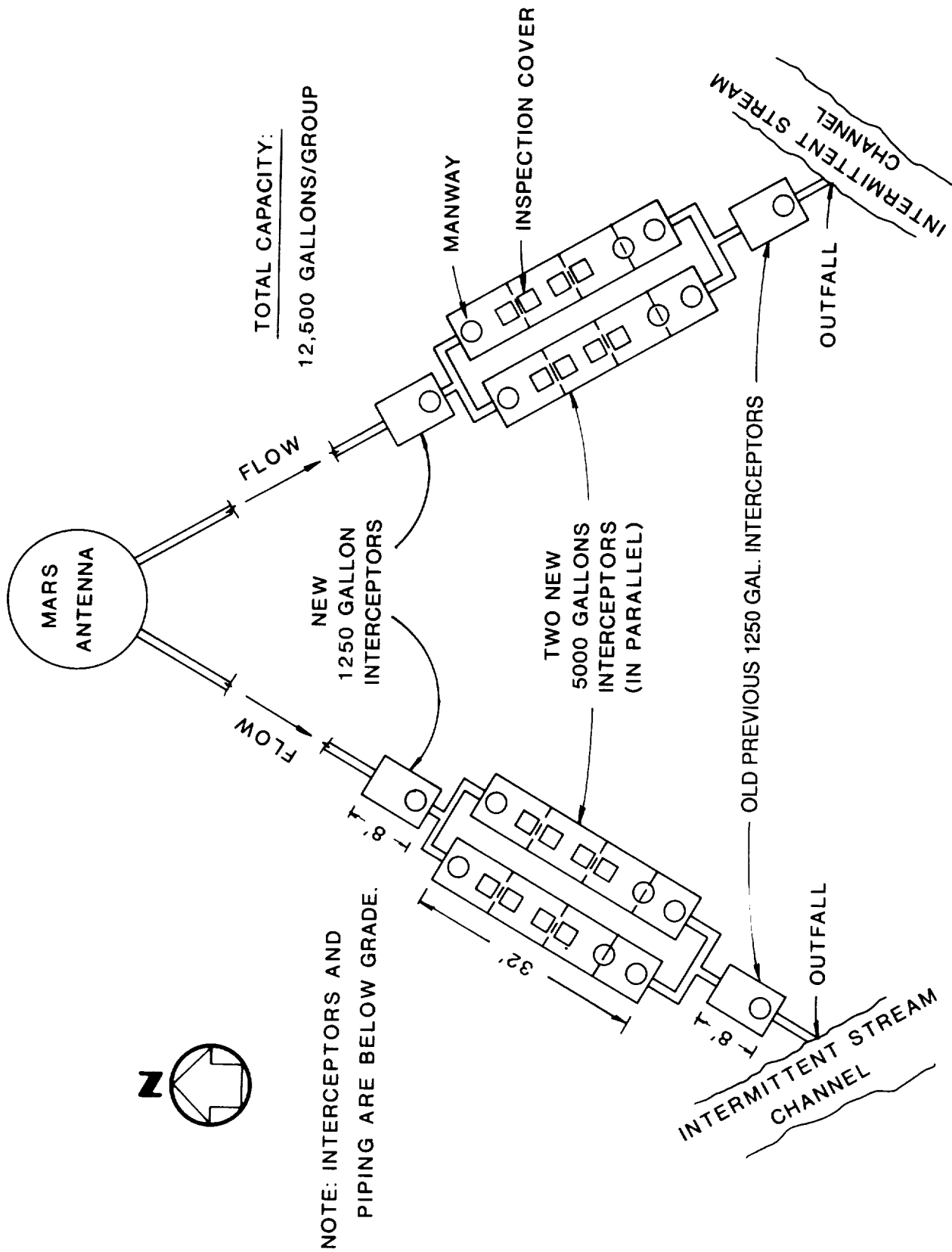


Figure 48. Mars Site: Two Groups, Each of Four Concrete Tanks, Now Form the New Hydraulic Oil Interceptor System

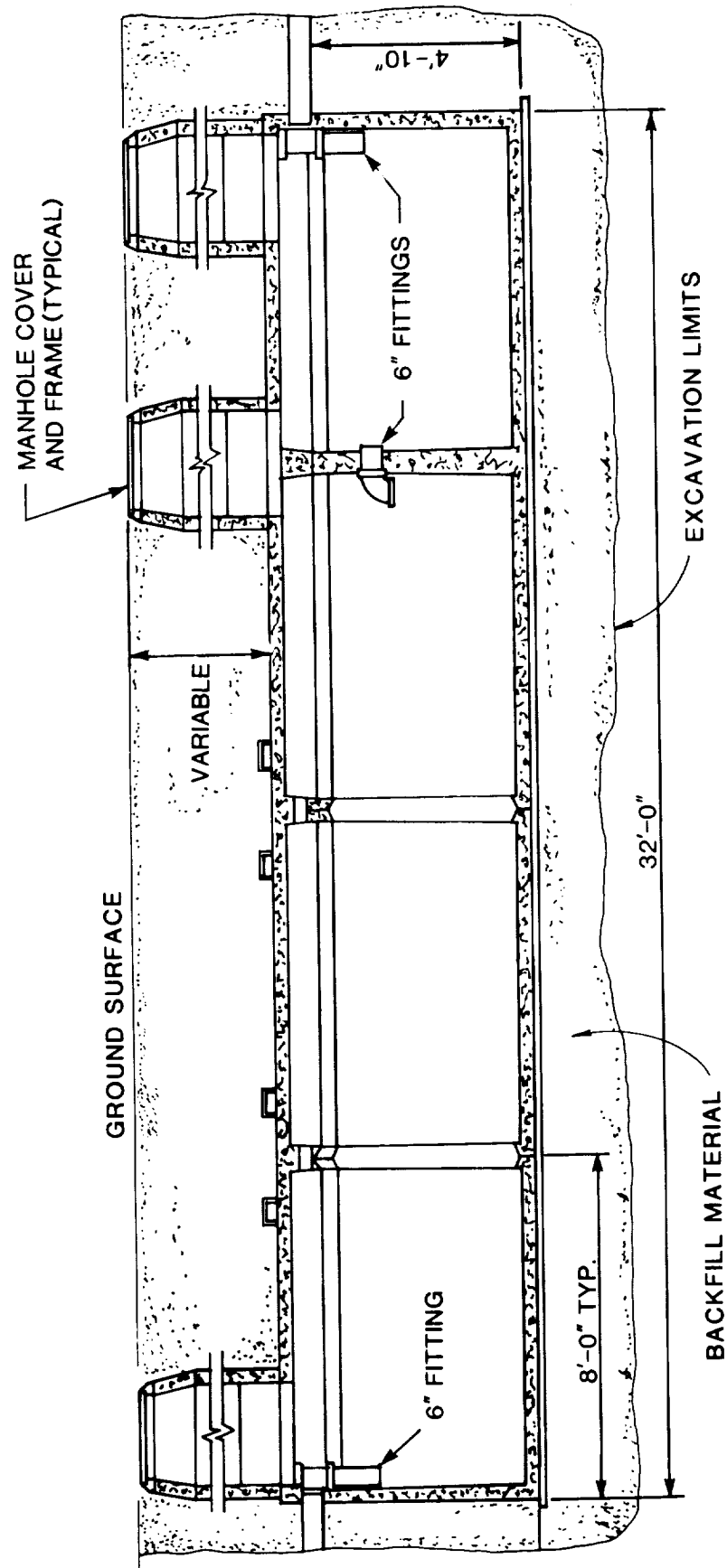


Figure 49. Mars Site: Cross Section of a Typical, Precast Concrete, 5,000 Gallon Oil/Water Separator Unit of the New Hydraulic Oil Interceptor System

100-443887-100

SECTION VII
CERTIFICATION

I hereby certify that all engineering work overseen by Engineering-Science, Inc., Pasadena, California, and its subcontractors, at the Goldstone Deep Space Communications Complex (GDSCC) of the Fort Irwin Military Reservation, San Bernardino County, California, in the removal/abandonment of 26 old, single-walled, underground storage tanks (USTs) and their replacement with 13 new, double-walled USTs at various sites of the GDSCC, and the expansion of the capacities of the hydraulic oil interceptors at the Mars Site of the GDSCC, as described in this report, was performed in compliance with Federal, state and local regulations, and in accordance with good engineering and investigative practice.

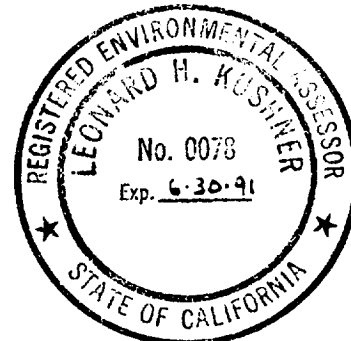
Leonard H. Kushner
Registered Professional Engineer

Signature Leon Kushner
Date Signed February 15, 1991

Registration No. E9003 Electrical
SF1086 Safety
REA0078 Environmental
Assessor

State: California
California
California

Stamp/Seal



~~SECRET~~ INTENTIONALLY ~~SECRET~~

APPENDIX A

CORRESPONDENCE CONCERNING THE DESTRUCTION OF
24 OLD TANKS REMOVED FROM THE GDSCC

100-443888-100

AVACON SALVAGE, INC.

24399 HIGHWAY 58
HINKLEY, CA 92547
(619) 253 7408

March 27, 1989

Jenkin Construction
2650 Lime Avenue
Long Beach, CA 90806

Dear Sirs:

On January 19 through February 21, 1989, we received inert and degassed tank shells from the Goldstone Tracking Station. This is to certify the receipt and destruction of same.

January 19, 1989

10,000 gal. tank - G25-1G
12,000 gal. tank - G27-2D
15,000 gal. tank - G27-3D
12,000 gal. tank - TF-3D
12,000 gal. tank - TF-4D

January 20, 1989

10,000 gal. tank - 14-1HO
10,000 gal. tank - 14-2HO
12,000 gal. tank - G81-2D
12,000 gal. tank - G81-3D
24,000 gal. tank - M9-3D
24,000 gal. tank - M9-2D

January 23, 1989


24,000 gal. tank - M9-1D

February 21, 1989

12,000 gal. tank - G24-1D
12,000 gal. tank - G24-2D

This completes the list of tanks received and destroyed through this date.

Sincerely,



Manuel R. Gonzalez
President

ADALON SALVAGE INC.

24399 HIGHWAY 58
HINKLEY, CA 92347
(619) 253-7408

April 25, 1989

Jenkin Construction
2650 Lime Avenue
Long Beach, CA 90806

Dear Sirs:

On April 24, 1989, we received inert and degassed tank shells from the Goldston Tracking Station. This is to certify the receipt and destruction of same.

4,000 gal tank - M27-1G
920 gal tank - 14-1W0

This completes the list of tanks received and destroyed through this date.

Sincerely,



Manuel R. Gonzalez
President



REPLY TO:
P. O. BOX 1427
LONG BEACH,
CALIFORNIA 90801
STATE LIC. #245128

JENKIN CONSTRUCTION CO., 2650 LIME AVENUE, LONG BEACH, CALIFORNIA (213) 426-9351

May 8, 1989

Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California 91109

Attention: Mr. Glen Kroll
Project Engineer

Reference: Contract No. 958381
Goldstone Environmental Projects
Tank Demolition

Gentlemen:

This is to certify that the following tanks were cleaned,
removed from the ground, cut up and delivered as scrap metal
to Avalon Salvage, Inc., 24399 Highway 58, Hinkley, California
92347:

G42-1G	A1-1G
G42-2D	A1-2G
M9-4WO	G70-1
M56-1WO	G71-1

Please find, attached, two letters from Avalon Salvage, dated
March 27, and April 25, 1989, certifying receipt and destruction
of certain other tanks.

Tanks G27-1G, G81-1DA and G81-1DB were cleaned but not removed
from the ground at the request of JPL personnel.

Very truly yours,

JENKIN CONSTRUCTION CO.

L. L. Thomas
Project Manager

LLT:sd

INTENTIONALLY

APPENDIX B

CLEANING AND EXPLOSION-LEVEL TESTING RECORDS
FOR THE OLD USTs AT THE GDSCC



**STERLING
SUPPLY
company**

6635 E. Florence Ave., Unit #331
Bell Gardens, California 90201
(213) 927-3363

January 9, 1989

To: Cleaning & Pumping Specialists Co.
2669 Myrtle Avenue Suite 111
Long Beach, Calif. 90807

Certify:

1 each model GX3 Gas & Oxygen monitor s/n X 8165
was calibrated on methane and air for L.E.L. and
nitrogen for oxygen.

Work was done by approved Gastech repair station
in Anaheim, Calif. November 9, 1988 on w/o #6676

Safety dept.

Sterling Supply Co.

John Van Leersum

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 4-21-89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:

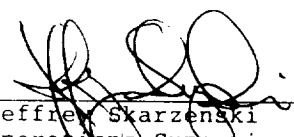
Regarding the 12,000 Gallon Unleaded Tank 627-10
at the Echo facility located at the Goldstone
Complex:

Cleaned 4-21-89
Visual Inspection Clean
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.


Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 1-16-89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:

Regarding the 12,000 Gallon Diesel Tank 927-2D
at the Echo facility located at the Goldstone
Complex:

Cleaned 1-13-89
Visual Inspection Clean
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.



Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

January 16, 1989

Jenkin Construction Company
Post Office Box 1427
Long Beach, California 90801

Gentlemen:

Regarding the 15,000 Gallon Diesel Tank G27-3D at the Echo Facility, located at the Goldstone Complex:

Cleaned - 1-13-89

Visual Inspection - Clean

Lower Explosion Level - 0 Percent

Oxygen Content - 21 Percent

All calibrations were done with a Gx3 Gas and Oxygen Monitor, Serial Number X8165.

CLEANING & PUMPING SPECIALISTS, INC.



Jeff Skarzenski
Supervisor Operations

JS:mgb

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 1-20-89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:


Regarding the 10,000 Gallon Unleaded Gasoline TANK G25-1G
at the ECHO facility located at the Goldstone
Complex:

Cleaned 1-19-89
Visual Inspection Clean
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.


Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 1-20-89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:

Regarding the 2,000 Gallon Unleaded Gasoline TANK G42-1G
at the Echo facility located at the Goldstone
Complex:

Cleaned 1-19-89
Visual Inspection Clean
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.



Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 1-20-89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:

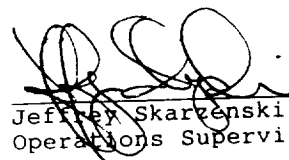
Regarding the 2,000 Gallon Dressel Fuel Tank G42-2D
at the Echo facility located at the Goldstone
Complex:

Cleaned 1-19-89
Visual Inspection CLEAR
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.


Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 2-17-89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:

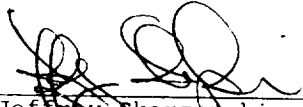
Regarding the 12,000 Gallon Diesel Tank G24-1D
at the Echo facility located at the Goldstone
Complex:

Cleaned 2-16-89
Visual Inspection CLEAN
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.



Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 2-17-89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:


Regarding the 12,000 Gallon Diesel Tank G24-2D
at the Echo facility located at the Goldstone
Complex:

Cleaned 2-16-89
Visual Inspection Clean
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.


Jeffrey Skamzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 1-20-89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:


Regarding the 12,000 GALLON Diesel TANK TF-3D
at the Echo facility located at the Goldstone
Complex:

Cleaned 1-20-89
Visual Inspection Clean
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.


Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 1-20-89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:

Regarding the 12,000 Gallon Diesel Tank TF-40
at the Echo facility located at the Goldstone
Complex:

Cleaned 1-20-89
Visual Inspection Clean
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.


Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

January 16, 1989

Jenkin Construction Company
Post Office Box 1427
Long Beach, California 90801

Gentlemen:

Regarding the 12,000 Gallon Diesel Tank G81-2D at the
Mars Facility, located at the Goldstone Complex:

Cleaned - 1-11-89

Visual Inspection - Clean

Lower Explosion Level - 0 Percent

Oxygen Content - 21 Percent

All calibrations were done with a Gx3 Gas and Oxygen
Monitor, Serial Number X8165.

CLEANING & PUMPING SPECIALISTS, INC.



Jeff Skarzenski
Supervisor Operations

JS:mgb

CLEANING AND PUMPING SPECIALISTS, INC.

January 16, 1989

Jenkin Construction Company
Post Office Box 1427
Long Beach, California 90801

Gentlemen:

Regarding the 12,000 Gallon Diesel Tank G81-3D at the
Mars Facility, located at the Goldstone Complex:

Cleaned - 1-11-89

Visual Inspection - Clean

Lower Explosion Level - 0 Percent

Oxygen Content - 21 Percent

All calibrations were done with a Gx3 Gas and Oxygen
Monitor, Serial Number X8165.

CLEANING & PUMPING SPECIALISTS, INC.



Jeff Skarzensky
Supervisor Operations

JS:mgb

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 4-18-89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:

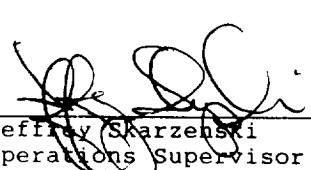
Regarding the ^{(C.S.I.D.A.) (G.S.I. 10.3)} Diesel Tanks # G8HDA - # G8HDB & Slop Oil Tank 14-1W0
at the MARS facility located at the Goldstone
Complex:

Cleaned 4-17-89 & 4-18-89
Visual Inspection Clean
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.


Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

January 16, 1989

Jenkin Construction Company
Post Office Box 1427
Long Beach, California 90801

Gentlemen:

Regarding the 10,000 Gallon Hydraulic Oil Tank 14-1HO
at the Mars Facility, located at the Goldstone Complex:

Cleaned - 1-12-89

Visual Inspection Level - 0 Percent

Oxygen Content - 21 Percent

All calibrations were done with a Gx3 Gas and Oxygen
Monitor, Serial Number X8165.

CLEANING & PUMPING SPECIALISTS, INC.



Jeff Skarzensky
Supervisor Operations

JS:mgb

CLEANING AND PUMPING SPECIALISTS, INC.

January 16, 1989

Jenkin Construction Company
Post Office Box 1427
Long Beach, California 90801

Gentlemen:

Regarding the 10,000 Gallon Hydraulic Oil Tank 14-2HO
at the Mars Facility, located at the Goldstone Complex:

Cleaned - 1-12-89


Visual Inspection - Clean

Lower Explosion Level - 0 Percent

Oxygen Content - 21 Percent

All calibrations were done with a Gx3 Gas and Oxygen
Monitor, Serial Number X8165.

CLEANING & PUMPING SPECIALISTS, INC.



Jeff Skarzensky
Supervisor Operations

JS:mgb

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 1-20-89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:


Regarding the 24,000 Gallon Diesel Tank M9-1D
at the McJAVE facility located at the Goldstone
Complex:

Cleaned 1-17-89
Visual Inspection Clean
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.



Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

DATE:

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:

Regarding the 24,000 Gallon Diesel Tank M9-2D
at the MoJave facility located at the Goldstone
Complex:

Cleaned 1-18-89
Visual Inspection Clean
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.


Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 1-20-89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:


Regarding the 24,000 Gallon Diesel Tank M9-3D
at the McJave facility located at the Goldstone
Complex:

Cleaned 1-18-89
Visual Inspection Clean
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.



Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

DATE:

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:


Regarding the 500 Gallon White Oil Tank M9-4Wc
at the Mojave facility located at the Goldstone
Complex:

Cleaned 1-18-89
Visual Inspection Clean
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.


Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 1-20-89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:

Regarding the 7,500 Gallon Waste Oil Tank M56-1W0
at the MoJave facility located at the Goldstone
Complex:

Cleaned 1-19-89
Visual Inspection Clean
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.



Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 4-21-89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:

Regarding the 4,000 Gallon Unleaded TANK M27-1G
at the MoJave facility located at the Goldstone
Complex:

Cleaned 4-21-89
Visual Inspection Clean
Lower Explosion level 0%
Oxygen Content 21 percent

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.


Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 1-20-89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:

Regarding the 4,000 Gallon Unleaded Gasoline TANK A1-1G
at the Apple facility located at the Goldstone
Complex:

Cleaned 1-19-89
Visual Inspection CLEAN
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.



Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

DATE: 1/20/89

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801

Gentlemen:


Regarding the 7,500 Gallon Unleaded Gasoline TANK A1-2G
at the Apollo facility located at the Goldstone
Complex:

Cleaned 1-19-89
Visual Inspection Clean
Lower Explosion level 0%
Oxygen Content 21%

All calibrations were done with a Gx3 gas and oxygen monitor,
Serial # X8165.

Thank you,

CLEANING & PUMPING SPECIALIST
INC.



Jeffrey Skarzenski
Operations Supervisor

JS/vh

CLEANING AND PUMPING SPECIALISTS, INC.

January 16, 1989

Jenkin Construction Company
Post Office Box 1427
Long Beach, California 90801

Gentlemen:

Regarding the 2,000 Gallon Aviation Fuel Tank G71-1 at the Goldstone Dry Lake Airport Facility, located at the Goldstone Complex:

Verified Clean - 1-12-89


Visual Inspection - Clean

Lower Explosion Level - 0 Percent

Oxygen Content - 21 Percent

All calibrations were done with a Gx3 Gas and Oxygen Monitor, Serial Number X8165.

CLEANING & PUMPING SPECIALISTS, INC.



Jeff Skarzensky
Supervisor Operations

JS:mgb

2669 MYRTLE AVE., SUITE 111, SIGNAL HILL, CA 90806 • P.O. BOX 91807, LONG BEACH, CA 90809-1807 • (213) 595-1000

CLEANING AND PUMPING SPECIALISTS, INC.

January 16, 1989

Jenkin Construction Company
Post Office Box 1427
Long Beach, California 90801

Gentlemen:

Regarding the 100 Gallon Gasoline Tank G70-1 at the Goldstone Dry Lake Airport Facility, located at the Goldstone Complex:

Cleaned - 1-12-89


Visual Inspection - Clean

Lower Explosion Level - 0 Percent

Oxygen Content - 21 Percent

All calibrations were done with a Gx3 Gas and Oxygen Monitor, Serial Number X8165.

CLEANING & PUMPING SPECIALISTS, INC.



Jeff Skarzensky
Supervisor Operations

JS:mgb

2669 MYRTLE AVE., SUITE III, SIGNAL HILL, CA 90806 • P.O. BOX 91807, LONG BEACH, CA 90809-1807 • (213) 595-1000

APPENDIX C

WARRANTIES FOR THE 13 NEW USTs AT THE GDSCC
AS PROVIDED BY K&T STEEL CORPORATION,
TWIN FALLS, IDAHO

11/11/11

◆◆◆WARRANTY◆◆◆

**PLASTEEL Composite® Underground
Petroleum/Motor Fuel Storage Tank
Single Wall and Double Wall**

OWNER NAME: Joor Manufacturing
1189 Industrial Ave.
Escondido, CA
OWNER ADDRESS:
INSTALLATION ADDRESS: Jenkin Construction
JPL Goldstone Facility
Fort Irwin Military
U.L. NUMBER: L158054
TYPE: Double Wall
CAPACITY: 25,000 Gallon
SHIPMENT DATE: February 28, 1989

K & T STEEL CORP.

is pleased to extend, on the U.L. numbered tank and installation above when installed per our instructions and to comply with N.F.P.A. Pamphlet 30 for underground steel tanks, the following warranty:

K & T STEEL CORP.

warrants the subject **PLASTEEL Composite® Underground Tank:**

1. *to be free from defects in workmanship and materials for a period of five years from the date of shipment.*
2. *will not fail due to internal or external corrosion for a period of thirty (30) years from the date of shipment when used to store all motor fuels including but not limited to unleaded gasoline, leaded gasoline, gasohol in any alcohol blend percentages, 100% methanol, 100% ethanol, diesel fuel, jet fuel, kerosene and fuel oil. Consult manufacturer concerning other warranted liquids.*

This warranty is specifically limited, at our option, to the following:

1. *Repair of the tank at our factory, freight charges not included.*
2. *Replacement of tank delivered to point of original delivery.*
3. *Refund of the original purchase price.*

We are not liable for any labor, other installation or removal costs, indirect or consequential damages or any other damages in connection with these tanks.

Except as stated above, we make no warranty of merchantability, no warranty that our underground **PLASTEEL Composite®** tanks are fit for any particular purpose or use and no other warranty, expressed or implied.

◆◆WARRANTY◆◆

G24-2D

PLASTEEL Composite® Underground Petroleum/Motor Fuel Storage Tank Single Wall and Double Wall

OWNER NAME: Joor Mfg. Co.
1189 Industrial Ave.
OWNER ADDRESS: Escondido, CA
INSTALLATION: Jenkin Construction
ADDRESS: JPL Goldstone Facility
Fort Irwin Military
U.L. NUMBER: L158055
TYPE: Double Wall
CAPACITY: 25,000 Gallon
SHIPMENT DATE: February 28, 1989

K & T STEEL CORP.

is pleased to extend, on the U.L. numbered tank and installation above when installed per our instructions and to comply with N.F.P.A. Pamphlet 30 for underground steel tanks, the following warranty:

K & T STEEL CORP.

warrants the subject **PLASTEEL Composite® Underground Tank:**

1. *to be free from defects in workmanship and materials for a period of five years from the date of shipment.*
2. *will not fail due to internal or external corrosion for a period of thirty (30) years from the date of shipment when used to store all motor fuels including but not limited to unleaded gasoline, leaded gasoline, gasohol in any alcohol blend percentages, 100% methanol, 100% ethanol, diesel fuel, jet fuel, kerosene and fuel oil. Consult manufacturer concerning other warranted liquids.*

This warranty is specifically limited, at our option, to the following:

1. *Repair of the tank at our factory, freight charges not included.*
2. *Replacement of tank delivered to point of original delivery.*
3. *Refund of the original purchase price.*

We are not liable for any labor, other installation or removal costs, indirect or consequential damages or any other damages in connection with these tanks.

Except as stated above, we make no warranty of merchantability, no warranty that our underground **PLASTEEL Composite®** tanks are fit for any particular purpose or use and no other warranty, expressed or implied.

FORM: WRTY-106

◆◆WARRANTY◆◆

GSA-1
GSA-2

PLASTEEL Composite® Underground Petroleum/Motor Fuel Storage Tank Single Wall and Double Wall

OWNER NAME: Joor Manufacturing Co.
1189 Industrial Ave.
OWNER ADDRESS: Escondido, CA
INSTALLATION ADDRESS: Jenkin Construction
JPL Goldstone Facility
Fort Irwin Military
U.L. NUMBER: L158059 & L158060
TYPE: Double Wall
CAPACITY: 10,000 Gallon
SHIPMENT DATE: February 27, 1989

K & T STEEL CORP.

is pleased to extend, on the U.L. numbered tank and installation above when installed per our instructions and to comply with N.F.P.A. Pamphlet 30 for underground steel tanks, the following warranty:

K & T STEEL CORP.

warrants the subject **PLASTEEL Composite® Underground Tank:**

1. *to be free from defects in workmanship and materials for a period of five years from the date of shipment.*
2. *will not fail due to internal or external corrosion for a period of thirty (30) years from the date of shipment when used to store all motor fuels including but not limited to unleaded gasoline, leaded gasoline, gasohol in any alcohol blend percentages, 100% methanol, 100% ethanol, diesel fuel, jet fuel, kerosene and fuel oil. Consult manufacturer concerning other warranted liquids.*

This warranty is specifically limited, at our option, to the following:

1. *Repair of the tank at our factory, freight charges not included.*
2. *Replacement of tank delivered to point of original delivery.*
3. *Refund of the original purchase price.*

We are not liable for any labor, other installation or removal costs, indirect or consequential damages or any other damages in connection with these tanks.

Except as stated above, we make no warranty of merchantability, no warranty that our underground **PLASTEEL Composite®** tanks are fit for any particular purpose or use and no other warranty, expressed or implied.

FORM: WRTY-186

◆◆WARRANTY◆◆

G24-1W0
G42-2D

PLASTEEL Composite® Underground Petroleum/Motor Fuel Storage Tank Single Wall and Double Wall

OWNER NAME: JOOR Mfg. Co.
1189 Industrial Ave.
OWNER ADDRESS: Escondido, CA
INSTALLATION ADDRESS: Jenkin Construction
JPL Goldstone Facility
Fort Irwin Military
U.L. NUMBER: L158057, L158058
TYPE: Double Wall
CAPACITY: 3,000 Gallon
SHIPMENT DATE: February 23, 1989

K & T STEEL CORP.

is pleased to extend, on the U.L. numbered tank and installation above when installed per our instructions and to comply with N.F.P.A. Pamphlet 30 for underground steel tanks, the following warranty:

K & T STEEL CORP.

warrants the subject **PLASTEEL Composite® Underground Tank:**

1. to be free from defects in workmanship and materials for a period of five years from the date of shipment.
2. will not fail due to internal or external corrosion for a period of thirty (30) years from the date of shipment when used to store all motor fuels including but not limited to unleaded gasoline, leaded gasoline, gasohol in any alcohol blend percentages, 100% methanol, 100% ethanol, diesel fuel, jet fuel, kerosene and fuel oil. Consult manufacturer concerning other warranted liquids.

This warranty is specifically limited, at our option, to the following:

1. Repair of the tank at our factory, freight charges not included.
2. Replacement of tank delivered to point of original delivery.
3. Refund of the original purchase price.

We are not liable for any labor, other installation or removal costs, indirect or consequential damages or any other damages in connection with these tanks.

Except as stated above, we make no warranty of merchantability, no warranty that our underground **PLASTEEL Composite®** tanks are fit for any particular purpose or use and no other warranty, expressed or implied.

FORM: WRTY-186

♦♦♦WARRANTY♦♦♦

PLASTEEL Composite® Underground Petroleum/Motor Fuel Storage Tank Single Wall and Double Wall

OWNER NAME: Joor Mfg. Co.
 OWNER ADDRESS: 1189 Industrial Ave.
Escondido, CA 92025
 INSTALLATION ADDRESS: Jenkin Construction
JPL-Goldstone Fac.
Fort Irwin Military Res.
 U.L. NUMBER: L158043
 TYPE: Double Wall
 CAPACITY: 2,000 Gallon
 SHIPMENT DATE: February 8, 1989

K & T STEEL CORP.

is pleased to extend, on the U.L. numbered tank and installation above when installed per our instructions and to comply with N.F.P.A. Pamphlet 30 for underground steel tanks, the following warranty:

K & T STEEL CORP.

warrants the subject **PLASTEEL Composite® Underground Tank:**

1. *to be free from defects in workmanship and materials for a period of five years from the date of shipment.*
2. *will not fail due to internal or external corrosion for a period of thirty (30) years from the date of shipment when used to store all motor fuels including but not limited to unleaded gasoline, leaded gasoline, gasohol in any alcohol blend percentages, 100% methanol, 100% ethanol, diesel fuel, jet fuel, kerosene and fuel oil. Consult manufacturer concerning other warranted liquids.*

This warranty is specifically limited, at our option, to the following:

1. *Repair of the tank at our factory. freight charges not included.*
2. *Replacement of tank delivered to point of original delivery.*
3. *Refund of the original purchase price.*

We are not liable for any labor, other installation or removal costs, indirect or consequential damages or any other damages in connection with these tanks.

Except as stated above, we make no warranty of merchantability, no warranty that our underground **PLASTEEL Composite®** tanks are fit for any particular purpose or use and no other warranty, expressed or implied.

♦♦♦WARRANTY♦♦♦

G81-1D

PLASTEEL Composite® Underground Petroleum/Motor Fuel Storage Tank Single Wall and Double Wall

OWNER NAME: Joor Mfg. Co.
1189 Industrial Ave.
OWNER ADDRESS: Escondido, CA 92025
INSTALLATION: Jenkin Construction
ADDRESS: JPL-Goldstone Fac.
Fort Irwin Military Res.
U.L. NUMBER: L158052
TYPE: Double Wall
CAPACITY: 25,000 Gallon
SHIPMENT DATE: February 13, 1989

K & T STEEL CORP.

is pleased to extend, on the U.L. numbered tank and installation above when installed per our instructions and to comply with N. F. P. A. Pamphlet 30 for underground steel tanks, the following warranty:

K & T STEEL CORP.

warrants the subject **PLASTEEL Composite® Underground Tank:**

1. *to be free from defects in workmanship and materials for a period of five years from the date of shipment.*
2. *will not fail due to internal or external corrosion for a period of thirty (30) years from the date of shipment when used to store all motor fuels including but not limited to unleaded gasoline, leaded gasoline, gasohol in any alcohol blend percentages, 100% methanol, 100% ethanol, diesel fuel, jet fuel, kerosene and fuel oil. Consult manufacturer concerning other warranted liquids.*

This warranty is specifically limited, at our option, to the following:

1. *Repair of the tank at our factory. freight charges not included.*
2. *Replacement of tank delivered to point of original delivery.*
3. *Refund of the original purchase price.*

We are not liable for any labor, other installation or removal costs, indirect or consequential damages or any other damages in connection with these tanks.

Except as stated above, we make no warranty of merchantability, no warranty that our underground **PLASTEEL Composite®** tanks are fit for any particular purpose or use and no other warranty, expressed or implied.

FORM WRTY-106

◆◆WARRANTY◆◆

PLASTEEL Composite® Underground Petroleum/Motor Fuel Storage Tank Single Wall and Double Wall

OWNER NAME: Joor Mfg. Co.
 1189 Industrial Ave.
 OWNER ADDRESS: Escondido, CA
 INSTALLATION: Jenkin Construction
 ADDRESS: JPL Goldstone Facility
 Fort Irwin Military
 U.L. NUMBER: L158053
 TYPE: Double Wall
 CAPACITY: 25,000 Gallon
 SHIPMENT DATE: February 15, 1989

K & T STEEL CORP.

is pleased to extend, on the U.L. numbered tank and installation above when installed per our instructions and to comply with N.F.P.A. Pamphlet 30 for underground steel tanks, the following warranty:

K & T STEEL CORP.

warrants the subject **PLASTEEL Composite® Underground Tank:**

1. *to be free from defects in workmanship and materials for a period of five years from the date of shipment.*
2. *will not fail due to internal or external corrosion for a period of thirty (30) years from the date of shipment when used to store all motor fuels including but not limited to unleaded gasoline, leaded gasoline, gasohol in any alcohol blend percentages, 100% methanol, 100% ethanol, diesel fuel, jet fuel, kerosene and fuel oil. Consult manufacturer concerning other warranted liquids.*

This warranty is specifically limited, at our option, to the following:

1. *Repair of the tank at our factory. freight charges not included.*
2. *Replacement of tank delivered to point of original delivery.*
3. *Refund of the original purchase price.*

We are not liable for any labor, other installation or removal costs, indirect or consequential damages or any other damages in connection with these tanks.

Except as stated above, we make no warranty of merchantability, no warranty that our underground **PLASTEEL Composite®** tanks are fit for any particular purpose or use and no other warranty, expressed or implied.

◆◆WARRANTY◆◆

14-1H0

PLASTEEL Composite® Underground Petroleum/Motor Fuel Storage Tank Single Wall and Double Wall

OWNER NAME: Joor Mfg. Co.
1189 Industrial Ave.
OWNER ADDRESS: Escondido, CA 92025
INSTALLATION: Jenkin Construction
ADDRESS: JPL-Goldstone Fac.
Fort Irwin Military Res.
U.L. NUMBER: L158046
TYPE: Double Wall
CAPACITY: 10,000 Gallon
SHIPMENT DATE: February 8, 1989

K & T STEEL CORP.

is pleased to extend, on the U.L. numbered tank and installation above when installed per our instructions and to comply with N.F.P.A. Pamphlet 30 for underground steel tanks, the following warranty:

K & T STEEL CORP.

warrants the subject **PLASTEEL Composite® Underground Tank:**

1. *to be free from defects in workmanship and materials for a period of five years from the date of shipment.*
2. *will not fail due to internal or external corrosion for a period of thirty (30) years from the date of shipment when used to store all motor fuels including but not limited to unleaded gasoline, leaded gasoline, gasohol in any alcohol blend percentages, 100% methanol, 100% ethanol, diesel fuel, jet fuel, kerosene and fuel oil. Consult manufacturer concerning other warranted liquids.*

This warranty is specifically limited, at our option, to the following:

1. *Repair of the tank at our factory. freight charges not included.*
2. *Replacement of tank delivered to point of original delivery.*
3. *Refund of the original purchase price.*

We are not liable for any labor, other installation or removal costs, indirect or consequential damages or any other damages in connection with these tanks.

Except as stated above, we make no warranty of merchantability, no warranty that our underground **PLASTEEL Composite®** tanks are fit for any particular purpose or use and no other warranty, expressed or implied.

FORM: WRTY-186

◆◆WARRANTY◆◆

PLASTEEL Composite® Underground Petroleum/Motor Fuel Storage Tank Single Wall and Double Wall

OWNER NAME: Joor Mfg. Co.
1189 Industrial Ave.
OWNER ADDRESS: Escondido, CA 92025

INSTALLATION: Jenkin Construction
ADDRESS: JPL-Goldstone Fac.
Fort Irwin Military Res.

U.L. NUMBER: L158047

TYPE: Double Wall

CAPACITY: 10,000 Gallon

SHIPMENT DATE: February 8, 1989

K & T STEEL CORP.

is pleased to extend, on the U.L. numbered tank and installation above when installed per our instructions and to comply with N.F.P.A. Pamphlet 30 for underground steel tanks, the following warranty:

K & T STEEL CORP.

warrants the subject **PLASTEEL Composite® Underground Tank:**

1. *to be free from defects in workmanship and materials for a period of five years from the date of shipment.*
2. *will not fail due to internal or external corrosion for a period of thirty (30) years from the date of shipment when used to store all motor fuels including but not limited to unleaded gasoline, leaded gasoline, gasohol in any alcohol blend percentages, 100% methanol, 100% ethanol, diesel fuel, jet fuel, kerosene and fuel oil. Consult manufacturer concerning other warranted liquids.*

This warranty is specifically limited, at our option, to the following:

1. *Repair of the tank at our factory, freight charges not included.*
2. *Replacement of tank delivered to point of original delivery.*
3. *Refund of the original purchase price.*

We are not liable for any labor, other installation or removal costs, indirect or consequential damages or any other damages in connection with these tanks.

Except as stated above, we make no warranty of merchantability, no warranty that our underground **PLASTEEL Composite®** tanks are fit for any particular purpose or use and no other warranty, expressed or implied.

◆◆WARRANTY◆◆

14-1W0

PLASTEEL Composite® Underground Petroleum/Motor Fuel Storage Tank Single Wall and Double Wall

OWNER NAME: Joor Mfg. Co.
1189 Industrial Ave.
OWNER ADDRESS: Escondido, CA 92025
INSTALLATION: Jenkin Construction
ADDRESS: JPL-Goldstone Fac.
Fort Irwin Military Res.
U.L. NUMBER: L158042
TYPE: Double Wall
CAPACITY: 2,000 Gallon
SHIPMENT DATE: February 8, 1989

K & T STEEL CORP.

is pleased to extend, on the U.L. numbered tank and installation above when installed per our instructions and to comply with N.F.P.A. Pamphlet 30 for underground steel tanks, the following warranty:

K & T STEEL CORP.

warrants the subject **PLASTEEL Composite® Underground Tank:**

1. to be free from defects in workmanship and materials for a period of five years from the date of shipment.
2. will not fail due to internal or external corrosion for a period of thirty (30) years from the date of shipment when used to store all motor fuels including but not limited to unleaded gasoline, leaded gasoline, gasohol in any alcohol blend percentages, 100% methanol, 100% ethanol, diesel fuel, jet fuel, kerosene and fuel oil. Consult manufacturer concerning other warranted liquids.

This warranty is specifically limited, at our option, to the following:

1. Repair of the tank at our factory, freight charges not included.
2. Replacement of tank delivered to point of original delivery.
3. Refund of the original purchase price.

We are not liable for any labor, other installation or removal costs, indirect or consequential damages or any other damages in connection with these tanks.

Except as stated above, we make no warranty of merchantability, no warranty that our underground **PLASTEEL Composite®** tanks are fit for any particular purpose or use and no other warranty, expressed or implied.

FORM: WRTY-186

◆◆WARRANTY◆◆

PLASTEEL Composite® Underground Petroleum/Motor Fuel Storage Tank Single Wall and Double Wall

OWNER NAME: Joor Mfg. Co.
1189 Industrial Ave.
OWNER ADDRESS: Escondido, CA
INSTALLATION ADDRESS: Jenkin Construction
JPL Goldstone Facility
Fort Irwin Military
U.L. NUMBER: L158051
TYPE: Double
CAPACITY: 4,000 Gallon
SHIPMENT DATE: February 23, 1989

K & T STEEL CORP.

is pleased to extend, on the U.L. numbered tank and installation above when installed per our instructions and to comply with N.F.P.A. Pamphlet 30 for underground steel tanks, the following warranty:

K & T STEEL Corp.

warrants the subject **PLASTEEL Composite® Underground Tank:**

1. *to be free from defects in workmanship and materials for a period of five years from the date of shipment.*
2. *will not fail due to internal or external corrosion for a period of thirty (30) years from the date of shipment when used to store all motor fuels including but not limited to unleaded gasoline, leaded gasoline, gasohol in any alcohol blend percentages, 100% methanol, 100% ethanol, diesel fuel, jet fuel, kerosene and fuel oil. Consult manufacturer concerning other warranted liquids.*

This warranty is specifically limited, at our option, to the following:

1. *Repair of the tank at our factory, freight charges not included.*
2. *Replacement of tank delivered to point of original delivery.*
3. *Refund of the original purchase price.*

We are not liable for any labor, other installation or removal costs, indirect or consequential damages or any other damages in connection with these tanks.

Except as stated above, we make no warranty of merchantability, no warranty that our underground **PLASTEEL Composite®** tanks are fit for any particular purpose or use and no other warranty, expressed or implied.

INTERNATIONAL TEAM

APPENDIX D

CERTIFICATES OF INSTALLATION FOR THE 13 NEW USTs
AT THE GDSCC AS WITNESSED BY JOOR MANUFACTURING, INC.,
ESCONDIDO, CALIFORNIA

INTENTIONALLY BLANK

CERTIFICATE OF INSTALLATION

FOR THE

PLASTEEL COMPOSIT™ UNDERGROUND TANK

Echo Site.

G24-1D
G24-2D
G24-1W0

In compliance with Part 280 of Title 40 of the Code of Federal Regulations, this document may be implemented to meet Subpart B, paragraph 280.20 (e), CERTIFICATION OF INSTALLATION.

The installer must initial all sections below representing that the installer has read, was cognizant of and has completed, as applicable, all sections of the PLASTEEL COMPOSIT™ Tank Installation Instructions attached hereto.

INSTALLATION CHECK-OFF COMPLETION LIST

SECTION

I. GENERAL

II. VISUAL INSPECTION

III. HANDLING

IV. EXCAVATION DEPTH, BEDDING AND BACKFILL

V. ANCHORING SYSTEMS

VI. TESTING

VII. VENTING: DOUBLE WALL

VIII. PLASTEEL® SEALING PROCEDURES

INITIAL	DATE
DH	3-3-89
JS	3-3-89
JS	3-3-89
JS	3-3-89
None	
JS	3-3-89
optional	
meeting held	
3/2/89.	

INSTALLATION DESCRIPTION

PLASTEEL® TANK OWNER

NAME Jet Propulsion Laboratory

ADDRESS 4800 Oak Grove Drive

CITY, STATE, ZIP Pasadena, CA 91109

INSTALLATION SITE

ADDRESS Goldstone

CITY, STATE, ZIP Ft. Irwin, CA

PLASTEEL® TANK DATA

The U.L. Label and serial number is on the top centerline of the tank and also listed on the delivery document.

SIZE IN GALLONS	TYPE (DW OR SW)	U.L. SERIAL NUMBER
25,000 gal.	DW	L-158054
25,000 gal.	DW	L-158055
30,000 gal.	DW	L-158057

INSTALLATION COMPANY

NAME Jenkin Construction Co.

NAME

P.O. Box 1427

ADDRESS

Long Beach, CA 90801

CITY, STATE, ZIP

TELEPHONE (213) 426-9351

INSTALLATION COMPLETION/SUPERVISOR'S SIGNATURE

The responsible supervisor's signature below represents that phases I through VIII were properly completed per the PLASTEEL COMPOSIT™ Installation Instructions:

SIGNATURE Robert J. Zochowski DATE 3-3-89

PRINT NAME Robert J. Zochowski
Joor Manufacturing Inc.

YOUR PLASTEEL® TANK MANUFACTURER IS:

NAME Joor Manufacturing, Inc.

NAME

1189 Industrial Avenue

ADDRESS

Escondido, CA 92025

CITY, STATE, ZIP

TELEPHONE (619) 745-0971

CERTIFICATE OF INSTALLATION

FOR THE

PLASTEEL COMPOSIT™ UNDERGROUND TANK

Echo Site.

GSA-1
GSA-2

In compliance with Part 280 of Title 40 of the Code of Federal Regulations, this document may be implemented to meet Subpart B, paragraph 280.20 (e), CERTIFICATION OF INSTALLATION.

The installer must initial all sections below representing that the installer has read, was cognizant of and has completed, as applicable, all sections of the PLASTEEL COMPOSIT™ Tank Installation Instructions attached hereto.

PLASTEEL™ TANK DATA

The U.L. Label and serial number is on the top centerline of the tank and also listed on the delivery document.

SIZE IN GALLONS	TYPE (DW OR SW)	U.L. SERIAL NUMBER
10,000 gal	DW	L-158059
10,000 gal	DW	L-158060

INSTALLATION CHECK-OFF COMPLETION LIST

SECTION

- I. GENERAL
- II. VISUAL INSPECTION
- III. HANDLING
- IV. EXCAVATION DEPTH, BEDDING AND BACKFILL
- V. ANCHORING SYSTEMS
- VI. TESTING
- VII. VENTING, DOUBLE WALL
- VIII. PLASTEEL™ SEALING PROCEDURES

INITIAL DATE
DJS 3-3-89
DJS 3-3-89
DJS 3-3-89
DJS 3-3-89
None
DJS 3-3-89
optional
meeting held
3/2/89.

INSTALLATION COMPANY

Jenkin Construction Co.
NAME
P.O. Box 1427
ADDRESS
Long Beach, CA 90801
CITY STATE ZIP
(213) 426-9351
TELEPHONE

INSTALLATION COMPLETION/SUPERVISOR'S SIGNATURE

The responsible supervisor's signature below represents that phases I through VIII were properly completed per the PLASTEEL COMPOSIT™ Installation Instructions:

Robert J. Zerkowski
SIGNATURE DATE
PRINT NAME
Joer Manufacturing
YOUR PLASTEEL™ TANK MANUFACTURER IS:

INSTALLATION DESCRIPTION

PLASTEEL™ TANK OWNER

Jet Propulsion Laboratory
NAME
4800 Oak Grove Drive
ADDRESS
Pasadena, CA 91109
CITY STATE ZIP

INSTALLATION SITE

Goldstone
ADDRESS
Ft. Irwin, CA
CITY STATE ZIP

Joer Manufacturing, Inc.
NAME
1189 Industrial Avenue
ADDRESS
Escondido, CA 92025
CITY STATE ZIP
619 745-0971
TELEPHONE

CERTIFICATE OF INSTALLATION

FOR THE

PLASTEEL COMPOSIT™ UNDERGROUND TANK

In compliance with Part 280 of Title 40 of the Code of Federal Regulations, this document may be implemented to meet Subpart B, paragraph 280.20 (e), CERTIFICATION OF INSTALLATION.

The installer must initial all sections below representing that the installer has read, was cognizant of and has completed, as applicable, all sections of the PLASTEEL COMPOSIT™ Tank Installation Instructions attached hereto.

INSTALLATION CHECK-OFF COMPLETION LIST

SECTION

- I. GENERAL
- II. VISUAL INSPECTION
- III. HANDLING
- IV. EXCAVATION DEPTH, BEDDING AND BACKFILL
- V. ANCHORING SYSTEMS
- VI. TESTING
- VII. VENTING/DOUBLE WALL
- VIII. PLASTEEL® SEALING PROCEDURES

INITIAL DATE
JLH 3-16-89
JLH 3-16-89
JLH 3-16-89
JLH 3-16-89
None
JLH 3-16-89
optional
meeting held
3-2-89.

INSTALLATION DESCRIPTION

PLASTEEL® TANK OWNER

Jet Propulsion Laboratory
NAME
4800 Oak Grove Drive
ADDRESS
Pasadena, CA 91109
CITY STATE ZIP

INSTALLATION SITE

Goldstone
ADDRESS
Ft. Irwin, CA
CITY STATE ZIP

PLASTEEL® TANK DATA

The U.L. Label and serial number is on the top centerline of the tank and also listed on the delivery document.

SIZE IN GALLONS	TYPE (DW OR SW)	U.L. SERIAL NUMBER
3,000 gal.	DW	#L-158069
2,000 gal.	DW	#L-158043

INSTALLATION COMPANY

Jenkin Construction Co.
NAME
P.O. Box 1427
ADDRESS
Long Beach, CA 90801
CITY STATE ZIP
(213) 426-9351
TELEPHONE

INSTALLATION COMPLETION/SUPERVISOR'S SIGNATURE

The responsible supervisor's signature below represents that phases I through VIII were properly completed per the PLASTEEL COMPOSIT™ Installation Instructions.

Robert J. Zochowski
SIGNATURE
PRINT NAME
Jenkin Manufacturing

YOUR PLASTEEL® TANK MANUFACTURER IS:

Joor Manufacturing, Inc.
NAME
1189 Industrial Avenue
ADDRESS
Escondido, CA 92025
CITY STATE ZIP
(619) 745-0971
TELEPHONE

Marg Site

G81-1D

G81-2D

CERTIFICATE OF INSTALLATION

FOR THE

PLASTEEL COMPOSITTM UNDERGROUND TANK

In compliance with Part 280 of Title 40 of the Code of Federal Regulations, this document may be implemented to meet Subpart B, paragraph 280.20(c), CERTIFICATION OF INSTALLATION.

The installer must initial all sections below representing that the installer has read, was cognizant of, and has completed, as applicable, all sections of the PLASTEEL COMPOSITTM Tank Installation Instructions attached hereto.

PLASTEEL[®] TANK DATA

The U.L. Label and serial number is on the top centerline of the tank and also listed on the delivery document.

SIZE IN GALLONS	TYPE (DW OR SW)	U.L. SERIAL NUMBER
25,000	D.W.	L-158052
25,000	D.W.	L-158063

INSTALLATION CHECK-OFF COMPLETION LIST

SECTION

I. GENERAL

II. VISUAL INSPECTION

III. HANDLING

IV. EXCAVATION DEPTH, READING AND BACKFILL

V. ANCHORING SYSTEMS

VI. TESTING

VII. VENTING, DOUBLE WALL

VIII. PLASTEEL[®] SEALING PROCEDURES

INITIAL DATE

JH 5-17-89

JH 2-17-89

JH 2-21-89

JH 2-17-89

None

JH 2-17-89

optional

meeting held

3/2/89.

INSTALLATION COMPANY

Jenkin Construction Co.

NAME

P.O. Box 1427

ADDRESS

Long Beach, CA 90801

CITY, STATE, ZIP

213 426-9351

TELEPHONE

INSTALLATION COMPLETION/SUPERVISOR'S SIGNATURE

The responsible supervisor's signature below represents that phases I through VIII were properly completed per the PLASTEEL COMPOSITTM Installation Instructions:

Robert Zachowski 2-17-89

Robert Zachowski

Joor Manufacturing Inc.

YOUR PLASTEEL[®] TANK MANUFACTURER IS:

Joor Manufacturing, Inc.

NAME

1189 Industrial Avenue

ADDRESS

Escondido, CA 92025

CITY, STATE, ZIP

619 745-0971

TELEPHONE

INSTALLATION DESCRIPTION

PLASTEEL[®] TANK OWNER

Jet Propulsion Laboratory

NAME

4800 Oak Grove Drive

ADDRESS

Pasadena, CA 91109

CITY, STATE, ZIP

INSTALLATION SITE

Goldstone

ADDRESS

Ft. Irwin, CA

CITY, STATE, ZIP

CERTIFICATE OF INSTALLATION

FOR THE

PLASTEEL COMPOSITTM UNDERGROUND TANK

Moss Site.

14-1HO

14-2HO

In compliance with Part 280 of Title 40 of the Code of Federal Regulations, this document may be implemented to meet Subpart B, paragraph 280.20 (c) CERTIFICATION OF INSTALLATION.

The installer must initial all sections below representing that the installer has read, was cognizant of and has completed, as applicable, all sections of the PLASTEEL COMPOSITTM Tank Installation Instructions attached hereto.

PLASTEEL[®] TANK DATA

The U.L. Label and serial number is on the top centerline of the tank and also listed on the delivery document.

SIZE IN GALLONS	TYPE (DW OR SW)	U.L. SERIAL NUMBER
10,000	DW	L-158046
10,000	DW	L-158047

INSTALLATION CHECK-OFF COMPLETION LIST

SECTION

- I GENERAL
- II VISUAL INSPECTION
- III HANDLING
- IV EXCAVATION DEPTH, BEDDING AND BACKFILL
- V ANCHORING SYSTEMS
- VI TESTING
- VII VENTING DOUBLE WALL
- VIII PLASTEEL SEALING PROCEDURE

INITIAL DATE
JL 2-14-89
JL 2-14-89
JL 2-14-89
JL 2-14-89
JL 2-14-89
JL 2-14-89
optional
meeting held
3/2/89.

INSTALLATION COMPANY

Jenkin Construction Co.
P.O. Box 1427
Long Beach, CA 90801
213 426-9351

INSTALLATION COMPLETION/SUPERVISOR'S SIGNATURE

The responsible supervisor's signature below represents that phases I through VIII were properly completed per the PLASTEEL COMPOSITTM Installation Instructions.

Robert J. Zorowski
Joor Manufacturing Inc.
YOUR PLASTEEL TANK MANUFACTURER IS:

INSTALLATION DESCRIPTION

PLASTEEL[®] TANK OWNER

Jet Propulsion Laboratory

4800 Oak Grove Drive

Pasadena, CA 91109

INSTALLATION SITE

Goldstone

Ft. Irwin, CA

Joor Manufacturing, Inc.

1189 Industrial Avenue

Escondido, CA 92025

619 745-0971

14-1WO

FOR THE

PLASTEEL COMPOSIT™ UNDERGROUND TANK

The installer must initial all sections below representing that the installer has read, was cognizant of and has completed, as applicable, all sections of the PLASTEEL COMPOSIT[®] Tank Installation Instructions attached hereto.

The U.L. Label and serial number is on the top centerline of the tank and also listed on the delivery document.

SIZE IN GALLONS	TYPE (DW OR SW)	U.L. SERIAL NUMBER
2,000 gal.	DW	L-158042

TELEPHONE

M8-1G

PLASTEEL COMPOSIT™ UNDERGROUND TANK

D-9

INTELLIGENCE REPORT

APPENDIX E

CALIBRATION CHARTS FOR THE 13 NEW USTs AT THE GDSCC
AS PROVIDED BY JOOR MANUFACTURING, INC.,
ESCONDIDO, CALIFORNIA

RECEIVED

TYPE 7



MANUFACTURING

GSA-1
GSA-2

CALIBRATION CHART
10000 GALLON DOUBLE WALL TANK 113 OD X 20'-5" DIA
INNER TANK 111 ID X 240

DEPTH	GALLONS	DEPTH	GALLONS	DEPTH	GALLONS
		80	7756	40	3263
		79	7654	39	3152
		78	7548	38	3043
		77	7443	37	2934
		76	7336	36	2825
		75	7229	35	2718
		74	7120	34	2611
		73	7011	33	2505
		72	6901	32	2400
		71	6791	31	2296
		70	6680	30	2193
		69	6568	29	2091
		68	6456	28	1991
		67	6344	27	1891
		66	6231	26	1793
		65	6117	25	1696
		64	6003	24	1600
		63	5889	23	1506
		62	5775	22	1413
		61	5660	21	1322
		60	5545	20	1232
		59	5430	19	1145
		58	5315	18	1059
		57	5200	17	975
		56	5084	16	893
		55	4969	15	813
		54	4854	14	735
		53	4739	13	660
		52	4624	12	587
		51	4480	11	516
		50	4394	10	449
		49	4279	9	384
		48	4165	8	323
		47	4050	7	265
		46	3937	6	211
		45	3823	5	161
		44	3710	4	115
		43	3598	3	75
		42	3486	2	41
		41	3374	1	15
111	10054				
110	10039				
109	10013				
108	9979				
107	9938				
106	9893				
105	9843				
104	9784				
103	9731				
102	9670				
101	9605				
100	9538				
99	9467				
98	9394				
97	9319				
96	9241				
95	9161				
94	9079				
93	8995				
92	8909				
91	8821				
90	8732				
89	8641				
88	8548				
87	8454				
86	8358				
85	8261				
84	8163				
83	8063				
82	7962				
81	7861				

1189 INDUSTRIAL AVENUE, ESCONDIDO, CALIFORNIA 92025 TELEPHONE (619) 745-0971 FAX (619) 746-9515

ORIGINAL PAGE IS
OF POOR QUALITY

E-3

PRECEDING PAGE BLANK NOT FILMED

TYPE 7

G42-1G
14-1W0

MANUFACTURING INC.

CALIBRATION CHART
2000 GALLON DUNFEE WALL TANK 94 ID X 8'-A 1041
INNER TANK 92 ID X 70

DEPTH	GALLONS	DEPTH	GALLONS	DEPTH	GALLONS
92	2014				
91	2014				
90	2004	60	1391	30	570
89	1995	59	1365	29	544
88	1984	58	1338	28	518
87	1972	57	1311	27	493
86	1959	56	1284	26	468
85	1944	55	1257	25	443
84	1929	54	1229	24	418
83	1913	53	1202	23	394
82	1896	52	1174	22	367
81	1878	51	1146	21	346
80	1860	50	1119	20	323
79	1841	49	1091	19	300
78	1821	48	1063	18	278
77	1801	47	1035	17	256
76	1780	46	1007	16	235
75	1758	45	979	15	214
74	1736	44	951	14	193
73	1714	43	924	13	199
72	1691	42	896	12	155
71	1668	41	868	11	136
70	1645	40	840	10	119
69	1621	39	813	9	102
68	1596	38	785	8	85
67	1572	37	758	7	70
66	1547	36	731	6	56
65	1521	35	704	5	43
64	1496	34	676	4	31
63	1470	33	650	3	20
62	1444	32	623	2	11
61	1418	31	597	1	4

1189 INDUSTRIAL AVENUE, ESCONDIDO, CALIFORNIA 92025 TELEPHONE (619) 745 0971 FAX (619) 746 9515

TYPE 7

M8-1G



MANUFACTURING INC.

CALIBRATION CHART
4000 GALLON DOUBLE WALL TANK 94" ID X 12'-1" DIA
INNER TANK 92" ID X 140

DEPTH	GALLONS	DEPTH	GALLONS	DEPTH	GALLONS
92	4029				
91	4028				
90	4007	60	2783	30	1141
89	3989	59	2729	29	1089
88	3968	58	2676	28	1037
87	3944	57	2622	27	986
86	3917	56	2568	26	935
85	3889	55	2513	25	886
84	3858	54	2458	24	836
83	3826	53	2403	23	788
82	3792	52	2348	22	735
81	3756	51	2293	21	693
80	3720	50	2237	20	646
79	3681	49	2182	19	601
78	3642	48	2126	18	556
77	3601	47	2070	17	512
76	3560	46	2014	16	469
75	3517	45	1959	15	428
74	3473	44	1903	14	387
73	3428	43	1847	13	348
72	3383	42	1792	12	309
71	3336	41	1736	11	272
70	3289	40	1681	10	237
69	3241	39	1626	9	203
68	3193	38	1571	8	171
67	3143	37	1516	7	140
66	3093	36	1461	6	112
65	3043	35	1407	5	85
64	2992	34	1353	4	61
63	2940	33	1299	3	40
62	2888	32	1246	2	22
61	2836	31	1193	1	8

1189 INDUSTRIAL AVENUE ESCONDIDO CALIFORNIA 92025 TELEPHONE (619) 745-0971 FAX (619) 746-9515

ORIGINAL PAGE IS
OF POOR QUALITY

TYPE 7

G24-1W0
G42-2D

MANUFACTURING INC.

CALIBRATION CHART
3000 GALLON DOUBLE WALL TANK 94 DD X 9'-3" GAL
INNER TANK 92 DD X 105

DEPTH	GALLONS	DEPTH	GALLONS	DEPTH	GALLONS
92	3022				
91	3021				
90	3005	60	2087	30	855
89	2992	59	2047	29	816
88	2976	58	2007	28	778
87	2958	57	1966	27	740
86	2938	56	1926	26	702
85	2916	55	1885	25	664
84	2894	54	1844	24	627
83	2869	53	1802	23	591
82	2844	52	1761	22	551
81	2817	51	1720	21	519
80	2790	50	1678	20	485
79	2761	49	1636	19	450
78	2731	48	1595	18	417
77	2701	47	1553	17	384
76	2670	46	1511	16	352
75	2638	45	1469	15	321
74	2605	44	1427	14	290
73	2571	43	1385	13	258
72	2537	42	1344	12	232
71	2502	41	1302	11	204
70	2467	40	1261	10	178
69	2431	39	1219	9	152
68	2394	38	1178	8	128
67	2357	37	1137	7	105
66	2320	36	1096	6	84
65	2282	35	1055	5	64
64	2244	34	1015	4	46
63	2205	33	975	3	30
62	2166	32	935	2	16
61	2127	31	895	1	6

1189 INDUSTRIAL AVENUE, ESCONDIDO, CALIFORNIA 92025 TELEPHONE (619) 745-0971 FAX (619) 746-9515

**ORIGINAL PAGE IS
OF POOR QUALITY**



G24-1D
G24-2D
G81-1D
G81-2D

MANUFACTURING INC.

CALIBRATION CHART
25000 GALLON TANK
INSIDE DIAMETER 120 INSIDE LENGTH 516

INCHES	GALLONS	INCHES	GALLONS	INCHES	GALLONS
120	25263	80	17892	40	7372
119	25231	79	17638	39	7120
118	25171	78	17383	38	6869
117	25095	77	17127	37	6621
116	25005	76	16869	36	6374
115	24903	75	16610	35	6130
114	24791	74	16350	34	5887
113	24670	73	16089	33	5647
112	24540	72	15827	32	5408
111	24402	71	15564	31	5172
110	24258	70	15300	30	4939
109	24106	69	15035	29	4708
108	23948	68	14770	28	4480
107	23785	67	14504	27	4255
106	23615	66	14237	26	4032
105	23441	65	13970	25	3813
104	23261	64	13703	24	3597
103	23076	63	13435	23	3384
102	22887	62	13168	22	3175
101	22693	61	12900	21	2969
100	22496	60	12632	20	2768
99	22294	59	12364	19	2570
98	22088	58	12096	18	2376
97	21879	57	11828	17	2187
96	21666	56	11560	16	2002
95	21450	55	11293	15	1823
94	21231	54	11026	14	1648
93	21009	53	10760	13	1479
92	20783	52	10494	12	1315
91	20555	51	10228	11	1157
90	20324	50	9964	10	1006
89	20091	49	9700	9	861
88	19855	48	9437	8	723
87	19617	47	9174	7	594
86	19376	46	8913	6	472
85	19134	45	8653	5	360
84	18889	44	8394	4	258
83	18642	43	8136	3	168
82	18394	42	7880	2	92
81	18144	41	7625	1	33

1189 INDUSTRIAL AVENUE, ESCONDIDO, CALIFORNIA 92025 TELEPHONE (619) 745-0971 FAX (619) 746-9515



14-1HO
14-2HO

MANUFACTURING INC.

CALIBRATION CHART					
10000 GALLON TANK					
INSIDE DIAMETER 93.5			INSIDE LENGTH 33.8		
INCHES	GALLONS	INCHES	GALLONS	INCHES	GALLONS
		67	7674	27	2373
		66	7549	26	2250
		65	7424	25	2129
		64	7297	24	2009
		63	7169	23	1890
		62	7040	22	1774
		61	6910	21	1659
		60	6779	20	1547
		59	6647	19	1436
		58	6514	18	1327
		57	6381	17	1221
		56	6247	16	1118
		55	6112	15	1017
93.5	10040	54	5977	14	918
93	10034	53	5842	13	823
92	10003	52	5706	12	730
91	9961	51	5570	11	641
90	9911	50	5433	10	556
89	9854	49	5297	9	474
88	9791	48	5160	8	397
87	9723	47	5023	7	324
86	9650	46	4886	6	255
85	9572	45	4750	5	192
84	9491	44	4613	4	135
83	9405	43	4477	3	85
82	9316	42	4341	2	43
81	9224	41	4205	1	12
80	9128	40	4069		
79	9030	39	3934		
78	8929	38	3800		
77	8825	37	3666		
76	8719	36	3532		
75	8611	35	3400		
74	8500	34	3268		
73	8387	33	3137		
72	8273	32	3007		
71	8156	31	2878		
70	8038	30	2750		
69	7918	29	2623		
68	7797	28	2497		

1189 INDUSTRIAL AVENUE, ESCONDIDO, CALIFORNIA 92025 TELEPHONE (619) 745-0971 FAX (619) 746-9515

—